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Electrical World

February 16, 1946

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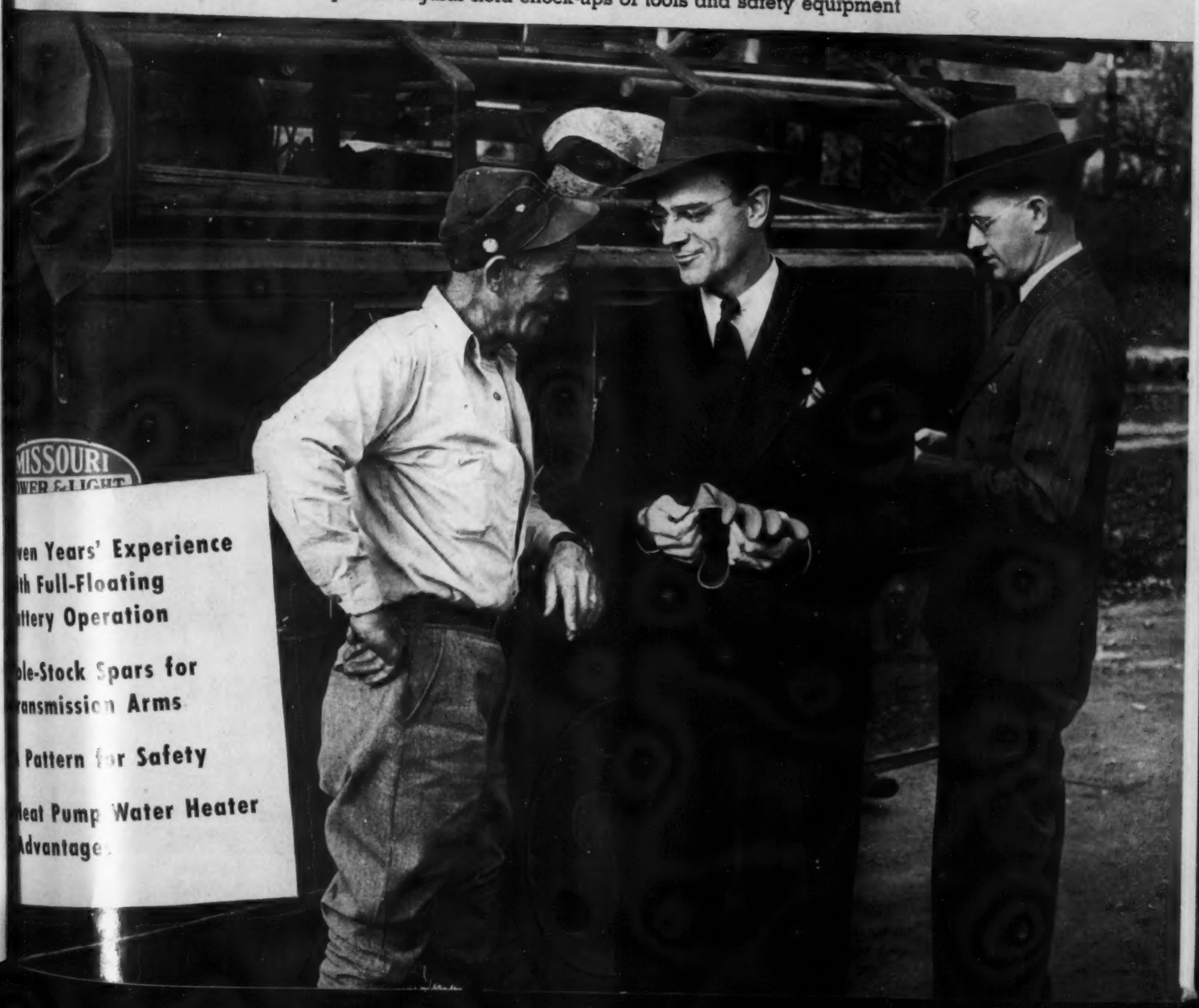

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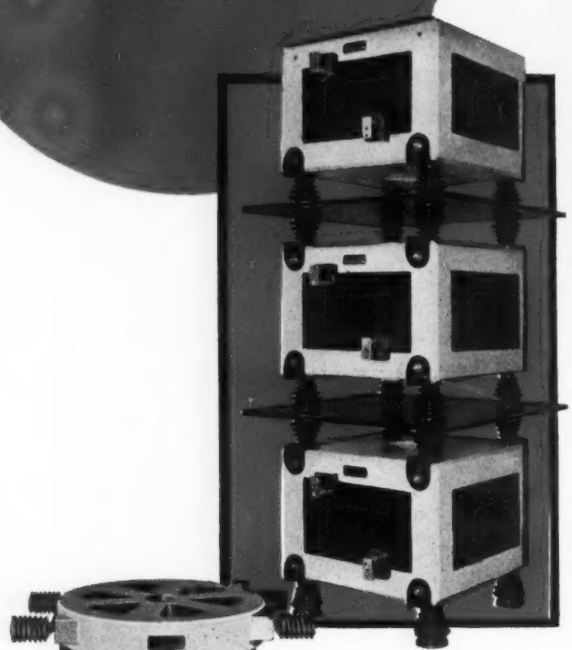

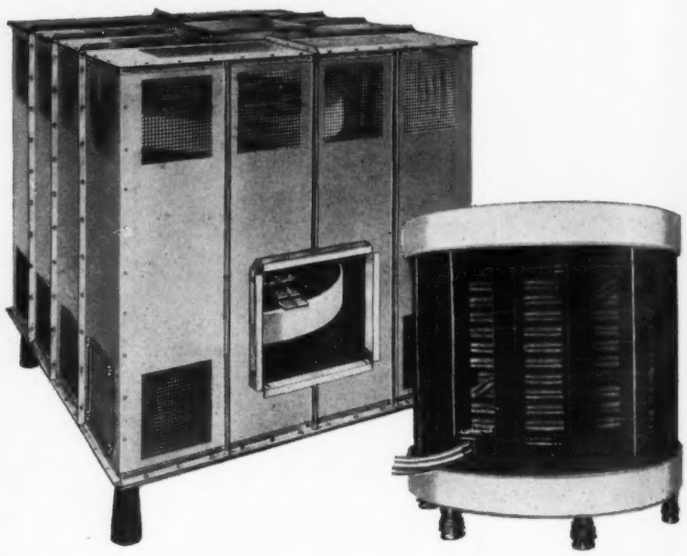

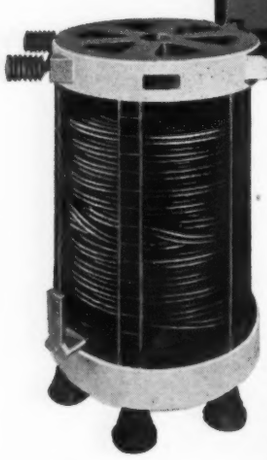

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Electrical World

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February 16, 1946 — Vol. 125, No. 7

Contents

Use Pole-Stock Spars as Transmission Arms 84
J. E. McKINSTER, Public Service Co. of Indiana, Inc.

Methodical Distribution System Changeover from 2.4 to 4.16 Kv. 86
FRED T. BEAR, Delaware Power & Light Co.

Safety Can Become a Pattern of Thought 88
HAROLD BRUEGGING, Missouri Power & Light Co.

Portable Test Set for Distribution Arresters 90
W. J. STEWART, The Ohio Power Co.

Storage Battery Charging and Full-Floating Operation—I 92
I. F. FREED, Consolidated Gas Electric Light & Power Co. of Baltimore

Heat Pump Water Heater Shows Promise 96
F. M. REED, Elton, Pa.

Hydrogen Gas Explosion Damages Condenser-Turbine 98
E. D. ST. JOHN, Kansas Gas & Electric Co.

Northwest Power Pool Reservoir Operation—II 100
E. N. PETERSON, Ebasco Services, Inc.

Editorials ..... 83 and 104

Washington Comment 106

News of the Week 107

HOW 115

Engineering Reference Sheets ..... 124, 126 and 128

Load Building 138

New Equipment 148

News About People 155

Manufacturing and Markets 168

Sales Opportunities 174

Recent Rate Changes 175

Letters to the Editor 176

Recent Legislation 177

Index of Advertisements 182

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Semicon tape is a strong cotton fabric impregnated and coated on both sides with a semi-conducting neoprene compound developed in the Okonite laboratories. It is applied between the Okoloy-coated conductor and the rubber insulation, being wrapped helically around the conductor with sufficient lap to insure complete coverage. It is bonded to the inner surface of the insulation during vulcanization so that no voids or spaces are present in which corona cutting of the inner surface of the insulation might start.

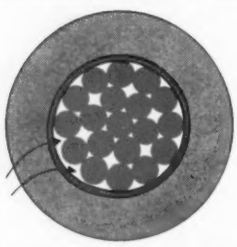
Comparative cross-section views at left show at a glance the advantages of Semicon tape . . . the absence of voids or air pockets next to the insulation at the conductor surface where the electrical stress is high.

Even under the most severe test conditions, no failure caused by internal corona cutting has ever developed in a cable made with Semicon tape, first used in Okonite-engineered cable in 1938. Furthermore, Semicon tape has considerably raised voltage test values. As a result, factory a-c high voltage tests have been increased by 25 percent, a standard Okonite precaution that provides additional insurance against the possibility of insulation defects.

For further information on Semicon tape and the high voltage cables in which it is used, get in touch with Okonite engineers. The Okonite Company, Passaic, N. J.

ADVANTAGES OF USING SEMICON TAPE

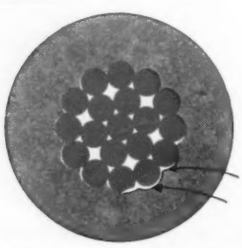
(Conductors Shown in Color)



AIR POCKETS EXCLUDED FROM DIELECTRIC FIELD

WITH SEMICON

1. Uniform stress conditions result from smooth, cylindrical conducting surface
2. No voids develop because Semicon tape and insulation are vulcanized together
3. No internal corona cutting can occur since the voids which cause it are eliminated



AIR POCKETS IN DIELECTRIC FIELD

WITHOUT SEMICON

1. Points of high stress exist because of irregular conductor surface
2. Voids, gaps or "pockets" can develop because cable movements may distort insulation
3. Voids under stress result in ionization (internal corona cutting)

OKONITE insulated wires and cables

4403

Electrical World

FEBRUARY 16, 1946

The 60-Cycle Opportunity

RECENTLY the head of the electrical engineering department of one of the country's leading universities asked if the colleges had been paying too much attention to electronics and communication and not enough to power.

Because of the need during the war for radar engineers particularly, the electrical engineering schools went in strongly for that kind of training. Now, however, we must get back to peace-time pursuits and look ahead toward the jobs awaiting graduates.

Judging from the men seeking employment with us, it appears that for a while at least we shall have in this country a feast of young engineers with high-frequency training and a famine of 60-cycle men. It is amazing to see how few of the young men now coming out of service have any knowledge of what the power field is like or any great desire to know.

Therefore, the answer to the teachers in our schools of electrical engineering is obviously yes, devote more time to power engineering.

It would be fine if we could let the problem rest there, but we can't because the next question from the educators is—Suppose we do train more power engineers, what have you to offer them by way of opportunity? So the problem finally comes right back to the place where it must be tackled initially—the industry.

After all, our colleges are there to provide the education the students want, not what industry wants. If the students do not want 60-cycle training, there must be a reason for it, because they used to crowd its facilities.

Vacuum tube results are challenging to belief even when one sees them and the tube has opened so many doors previously closed to humans that it is not difficult to understand its attraction to young men, but there are opportunities in 60-cycle power even more challenging in the benefits they can bring to the nation and to its people.

Do the men who are studying electrical engineering know what they are? Has the industry ever made an all-out effort to indoctrinate these young men in its future?

This year will be one of the largest years of expansion the industry has ever known and in several important respects it will be a record. What do the students know about it?

It is admitted that the vacuum tube lives in an atmosphere of romance but so did 60-cycle power only a few decades ago—and it still does for those who haven't been able to enjoy its advantages. Electric light and power have been so commonplace that even those in the industry no longer feel its romance. Let's find it again and present it to the young folks.

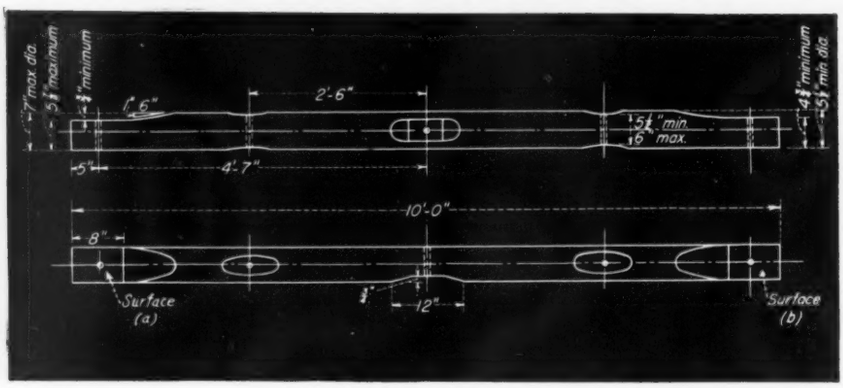
Of course, if we are going to talk to these young men we must be ready to answer frankly and honestly questions relating to advancement and compensation. Can men advance on merit, they will want to know, and earn as much as they could in other industries? Is it true that the industry is so operated that men quickly get into blind alleys and early find their road to advancement blocked?

When the industry gets the answers to all these questions, then it can say to the educators—There is an opportunity in 60-cycle power and this is what we mean. Until that is done the industry may have to content itself with taking what is left after the vacuum tube has captured the imagination of the best of the first and second string men.

Use Pole-Stock Spars As Transmission Arms

Indiana utility uses pole-stock round pine spars in lieu of conventional sawn crossarms on double-circuit transmission line—Comparative tests reveal strength to be adequate—Framing requirements prove critical factor in successful application—Angular tolerances established

J. E. McKINSTER, Engineer—Transmission, Public Service Co. of Indiana, Inc., Indianapolis



FRAMING DETAILS for 10-ft. round pine transmission crossarms. Angle between adzed surfaces is to be within 2½ deg. of 90. No adz gains for braces on 6-in. or smaller timbers; two gains when size exceeds 6½-in. diameter

POLE-STOCK pine spars that have been framed, barked and creosote-treated but otherwise are shaped as they were by nature were used recently in lieu of sawn crossarms in rebuilding 20 miles of 33/66-kv. double-circuit transmission line on the system of the Public Service Co. of Indiana, Inc.

This departure from conventional materials, while frankly exploratory, was not made blindly. Comparative strength tests had previously established that pole-stock round spars possessed adequate, if not greater, strength compared with fir arms. Experience with a few scattered pole-stock pine arms over the past ten years had indicated that life expectancy was good and finally, cost comparisons, in carload lots, indicated a substantial price differential in favor of the spar arms.

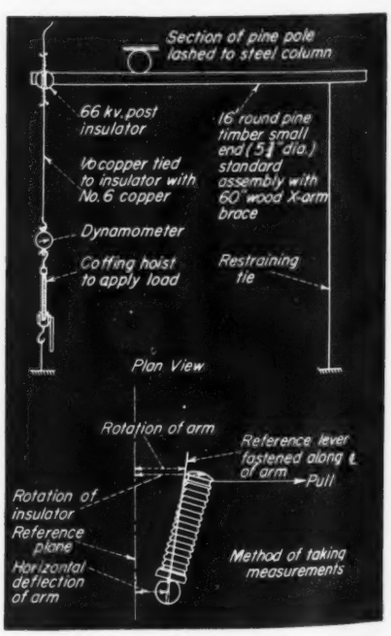
Comparative deflection data established by tests on round pine and 4¾ x5¾-in. fir arms is tabulated. The method of obtaining the data is illustrated. Test arms were bolted to a section of pole in the usual manner. The "free" end of the test arm was anchored and tension applied in 100-lb. steps up to 1,000 lb. to a 1/0 copper conductor fastened with a tie wire to a 66-kv. post-type insulator. The insulator groove was 20 in. above the top of the crossarm. In the case of the round spar arm the diameter of the loaded end of the arm was 5¾ in.

Acceptable Deflections

It will be seen from the data that the horizontal deflection of the pine and fir arms under 500-lb. load, which was selected as a typical working load, was 2 in. and 6⅞ in. respectively; torsional deflection of the arm alone 5½ and 3⅛ in., and of the insulator and arm assembly 7¾ and 5⅜ in., measured as indicated. These deflections were considered as acceptable.

Dimensional specifications for the round pine arms and details of framing proved to be the most critical factors in applying these arms to actual construction. It is obvious that wide variation in dimensions of the spars arms on the same pole would detract from appearance of the structure. Likewise any angular displacement of the pin insulators resulting from inaccurate framing would be equally intolerable.

It was required, therefore, that the diameters of the 10-ft. round pine arms be no greater than 7 in. and no less


Section of pine pole lashed to steel column
66 kv. post insulator
No. copper tied to insulator with No. 6 copper
16' round pine timber small end (5¾" dia.) standard assembly with 60" wood X-arm brace
Dynamometer
Coffing hoist to apply load
Restraining tie
Plan View
Rotation of arm
Reference lever fastened along ℄ of arm
Pull
Rotation of insulator
Reference plane
Horizontal deflection of arm
Method of taking measurements

TORSION TEST SETUP used to compare deflection of round pine and conventional 4¾ x 5¾-in. fir crossarms. Sketch at bottom of illustration shows how deflection measurements were taken

than 5½ in. They were to be "reasonably" free from knots and "as straight as possible," particularly in the horizontal plane where sweep would be most noticeable.

Angular Tolerances

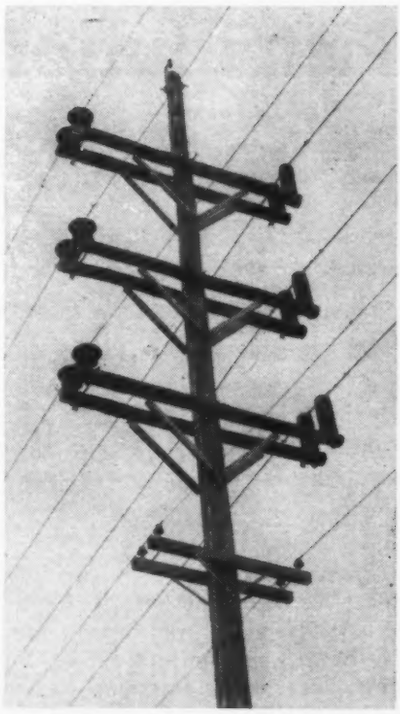
In framing it was required that the plane of the gain at the center through-bolt hole be within plus or minus 2½ deg. of perpendicular to the axis of the through-bolt hole and likewise that the plane of this gain be also within plus or minus 2½ deg. of normal to the plane of the slab gains forming the insulator seats.

Likewise, slab gains forming the insulator seats at the ends of the arms were required to be within plus or minus 2½ deg. of perpendicular to the insulator bolt hole. Moreover, thickness of wood remaining after cutting the gain was not permitted to exceed 5⅞ in. or be less than 4¾ in.

Observance of these angular tolerances in framing is essential to the good appearance of the finished transmission line.

Gains for crossarm braces were not required where thickness of wood was 6 in. or less. However, two adz gains were specified where timber thickness was in excess of 6½ in. Thickness of wood after gaining was not to be less than 5½ in.

With these framing specifications and angular tolerances established, a simple jig developed by the supplier insured that all arms met the specifications. With framing carefully controlled in this manner, appearance of the line is but little different from that of a similar line using rectangular sawn fir crossarms.



HIGHWAY CROSSING STRUCTURE showing double-arm construction used in rebuilding 20 miles of 33/66-kv. double-circuit transmission line

Pulverization by Steam

Pulverization of coal by use of superheated steam to carry crushed coal through an expanding nozzle (on somewhat the principle of cereals inflated when shot from pressure chambers) appears to offer real practicability. A paper by A. D. Singh (Institute of Gas Technology) and J. I. Yellott (Locomotive Development Committee), at the ASME convention in New York, last November, reporting studies originally aimed at gasification, indicated that the process can be commercially successful on a continuous basis. Somewhere between 0.5 and 0.7 pound of 90 psi. steam used per pound of coal increases the surface factor (index of pulverization) by ten times. That is, Kentucky bituminous of 16-40 screen emerges at 60-270 mesh after one pass. Not much ultrafine is produced.

Criterion of performance seems to be the rate of pressure drop in the nozzle. Values mentioned ranged from 200,000 to 550,000 psi per sec., the former corresponding to expansion from 85 to 47 psi. in a 327 microsecond passage through a fractional-inch rectangular orifice. Little gain results from passing the material through more than two or three times. A half-inch orifice was stated to pass about one ton per hour. The largest used in the experiments at Johns Hopkins University (Locomotive Development Committee research) has so far been ⅜ in.

The throttling-calorimeter effect of the expansion results in a significant amount of drying. The Kentucky bituminous of eight percent moisture content comes out with one percent and 30-percent-moisture of lignite is reduced to 3 percent. Air can also be used in place of steam and it has not proven explosive, despite the sparking in the nozzle.

Potentiality of air-pulverization for use in connection with gas turbines was indicated. In this case the recovery of pressure is facilitated by advantageous design of divergence of the nozzle; entrance configuration seems to make little difference. Only about 1 percent of the output of the gas turbine through the air compressor would be charged against the comminution process. The process is asserted to be feasible for limestone, shale, anthracite and other minerals—all respond to the phenomenon of released internal gas and vapor pressures.

Comparative Deflection Data Round Pine vs Sawn Fir Crossarm

Tension Lb.	5⅞ In.—Round Pine Arm					4 ⅞ In. x 5⅞ In. Fir Arm				
	Horizontal Movement Arm—In.	Rotation from Vertical				Horizontal Movement Arm—In.	Rotation from Vertical			
		Arm		Insulator			Arm		Insulator	
		*Inches	Angle	*Inches	Angle		*Inches	Angle	*Inches	Angle
100	3/16	3/16	0° 19′	3/16	0° 56′	3/16	3/16	0° 19′	3/16	0° 19′
200	1/4	1	2° 30′	1 3/16	3° 44′	2 3/16	1 3/16	2° 48′	1 3/16	3° 25′
300	3/4	3	7° 30′	4 1/4	10° 39′	3 3/16	1 5/16	4° 3′	2 3/16	5° 56′
400	1 1/4	4 5/16	11° 7′	6	15° 07′	5 3/16	2 5/16	6° 33′	4 3/16	10° 58′
	Tension released from 450 lb. for new purchase on loading hoist									
500	2	5 5/16	13° 50′	7 5/16	19° 41′	6 3/16	3 1/16	7° 48′	5 3/16	13° 31′
						Tension released from 500# for new purchase on restraining force on end of arm				
400						3/16	3 5/16	9° 04′	5 7/16	14° 48′
500						1 3/16	3 5/16	9° 04′	6 3/16	16° 05′
600	2	7	17° 43′	0	23° 02′	2 3/16	4 5/16	11° 36′	7 3/16	18° 42′
	Tension released from 675 lb. for new purchase on loading hoist									
700	2 3/4	7 3/4	19° 41′	10 3/4	27° 52′	3 1/16	4 7/16	12° 14′	8 5/16	22° 01′
800	3 1/2	8 1/2	21° 41′	11 1/2	30° 0′	4 1/16	5 1/16	13° 31′	10 1/16	26° 07′
						Tension released from 800# for new purchase on loading hoist				
900	4	8 3/4	22° 22′	12 1/2	32° 55′	4 7/16	5 1/16	12° 52′	10 3/16	26° 49′
1000						5 7/16	6 1/16	15° 27′	11 7/16	31° 05′

* Measured from top of insulator and top of 22 7/16" lever for arm.

Methodical Distribution System Changeover from 2.4 to 4.16 Kv.

Discusses advantages of method used in distribution system voltage changeover—At one stage three phases of 2.4 kv. and two phases of 4.16 kv. are available—Phases cut in singly rather than simultaneously

FRED T. BEAR, Distribution Engineer, Delaware Power & Light Co., Wilmington, Del.

PRINCIPAL FEATURE of this method of converting a 2.4-kv. delta distribution system to a 4.16-kv. wye system is the use of an intermediate step in which three phases of 2.4 kv. and two phases of 4.16 kv. are available. This permits reconnection of all open delta banks in advance of the final changeover to three phase, 4.16 kv. and thereby reduces the number of banks which must be simultaneously deenergized and reconnected.

It likewise reduces the number of work crews required and makes it easier to prearrange the necessary power customer outages. The method of conversion is one which allows the phases to be connected one at a time rather than simultaneously.

The attached diagrams summarize the steps. The numerals designate the sequence of operations in each step and the letters refer to the explanatory notes. The method has been successfully used in changing over twelve 300- to 600-kva. substations in four suburban areas.

During the cutover, when single-phase transformer connections are changed, the final connections are made. It is, therefore, unnecessary to work on them a second time.

With this method, it is possible to limit outages to the following:

1. Single-phase Transformers.

A phase—15 to 30 seconds, simultaneously.

B phase—1 to 2 minutes, individually.

C phase—No outage.

2. Three-phase Banks

Open delta—5 to 15 minutes, individually.

Closed delta—10 to 30 minutes, simultaneously.

However, in practice to increase safely the speed of performing the work, single-phase transformers usually have been interrupted for from one to two minutes to change connections and all phases have usually been interrupted for from 15 to 30 seconds at the time of the final switchover to 4.16 kv. The details and sequence of outages are discussed in the diagram explanatory notes.

Order of Conversion

In the system Fig. 1, the 4.16-kv. phase voltages lag the 2.4-kv. phase voltages. The order of conversion in this instance is C phase, B phase and then A phase. The method will work equally well for the leading connection but the phase conversion would be A phase, B phase and then C phase.

In planning Steps I and II (Figs. 3 and 4), phasing maps are prepared on tracing paper showing in pencil all phases and connections at the start of the step. Changes to be made are inked in over the pencil. Assignments are made to each line crew by giving the foreman a blueprint with the connections which he is to make marked in colored pencil. By using separate colors for each crew, the supervising engineer has a key map of all assignments.

Step III requires simultaneous outages of from 15 to 30 minutes on all closed delta banks and these are prearranged with the customers affected. Crews are assigned to each bank and have sketches showing the connection changes which are to be made.

At the prearranged time the bank is disconnected and, when completed, this fact is reported to the control point.

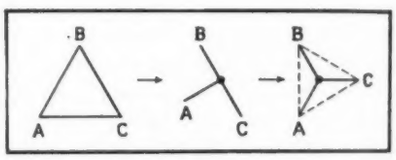


FIG. 1—Sequence when 4.16 kv. lags 2.4 kv. Phase conversion—C, B, A

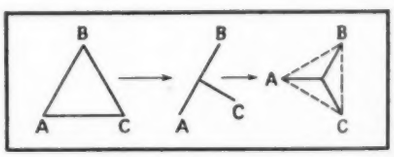


FIG. 2—Sequence when 4.16 kv. leads 2.4 kv. Phase conversion—A, B, C

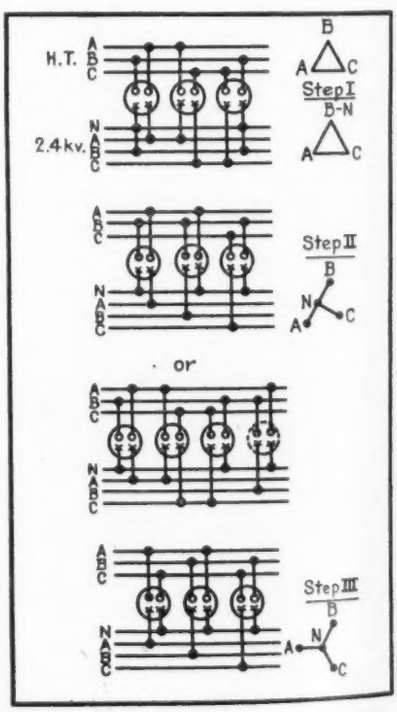


FIG. 3—Outline of steps in cutting over substation transformers

(The control point is usually at that substation which will pick up the 4.16-kv. load when the changeover is completed). After the line crew has completed the assigned reconnections, this fact is likewise reported to the control point and, if the substation transfer has been completed, the crew is ordered to close in.

Normally, after all crews have reported clear, the Step II supply station can be disconnected and the 4.16-kv. supply station closed in before the first line crew will have their bank reconnected and ready to close.

Power customers' service switches are always opened while the banks are being reconnected and, after the banks are reenergized, service phase rotation is checked before closing.

Means of communication between line crew and control point is optional. Messenger, telephone or radio can be used depending upon the conditions.

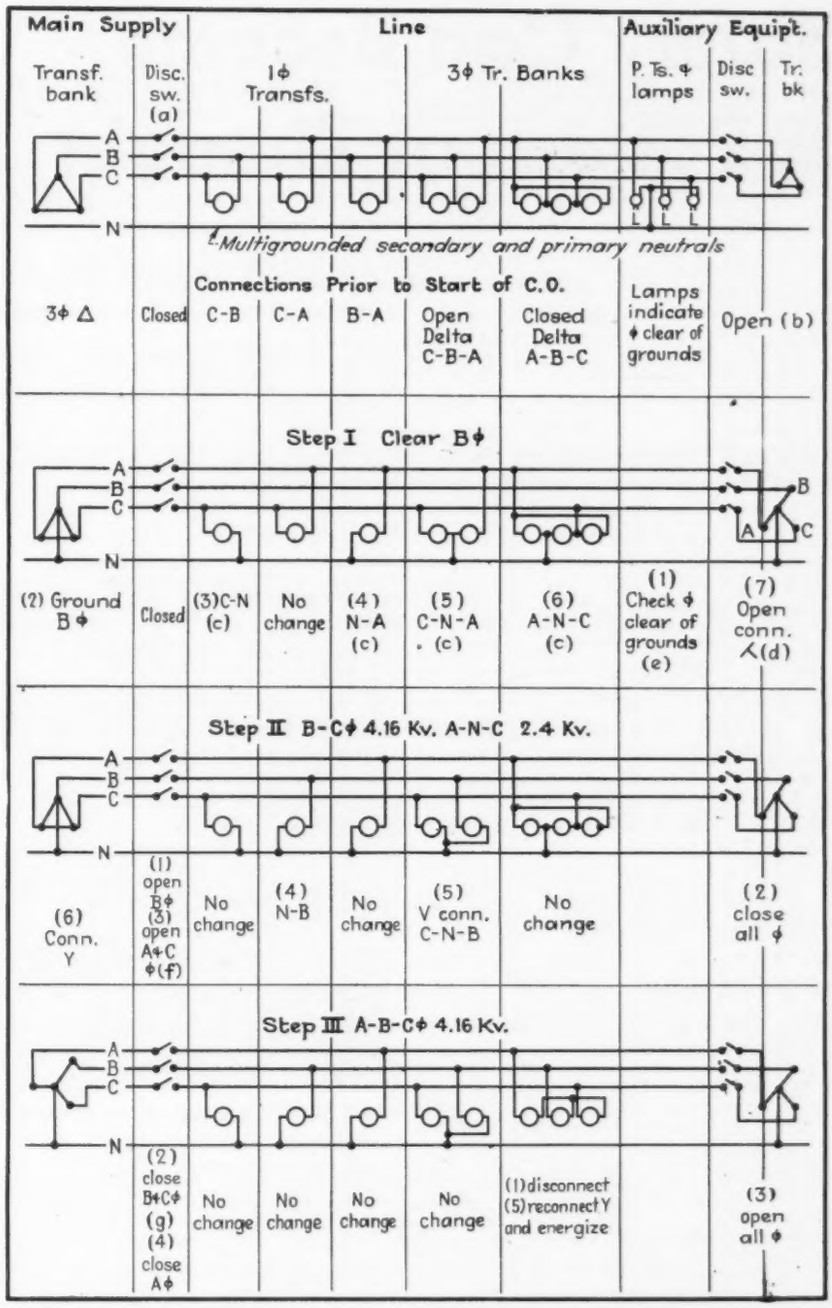


FIG. 4—Steps in changing over a 2.4-kv. delta system to a 4.16-kv. wye system. Numerals designate operation sequence in each step; letters refer to explanatory notes

DIAGRAM EXPLANATORY NOTES

(*a*) SPST disconnecting switches are shown. In most cases there will also be a 3PST oil switch or circuit breaker between the feeder disconnects and the main supply bank. Both disconnects and oil switches can be used in the various switching operations.

(*b*) Auxiliary transformer bank may be a temporary bank set up for the changeover; or adjoining, single-circuit substations can be paralleled and changed over as a unit, using one station as normal supply and the other as auxiliary supply for the changeover period.

(*c*) These steps cover transfer of all connections on B phase to the neutral and can be made without interruption by making the neutral connection before disconnecting from B phase. To avoid the danger of accidentally grounding A or C phases through mistaking it for B phase, the points to be connected should be checked with a pot transformer before making the connection. As it is not always possible to equip all crews with a pot transformer and insulated leads for making the test, it is usually made only on three-phase banks, and service on single-phase transformers is interrupted while the B phase lead is disconnected and tapped to the neutral. Secondary voltage on transformer should be checked after reconnection. If an A or C phase lead is transferred to neutral, there will be no voltage on the transformer.

(*d*) This connection can be made by reconnecting a bank of three single-phase transformers or by adding a fourth single-phase transformer to energize B phase. The separate transformer is required if three phase station transformers are used, or if load is too great for open delta supply.

(*e*) Auxiliary potential transformers and lamps for signalling are installed as a check that phases are clear of grounds before grounding B phase and are left in place through the changeover as a check on phase voltages and accuracy of switching operations.

(*f*) B phase is deenergized after all connections are removed and can be safely opened with an SP disconnect. Steps (2) and (3) can be switched by oil switches or circuit breakers.

(*g*) Switching indicated avoids outage on B and C phase and open delta connected transformers but does require picking up A phase load through an SP disconnect. Normally the 15-30 second outage caused by eliminating (1) and performing steps (3) and (4) as 3P oil switch operations is not objectionable.

Safety Can Become A Pattern of Thought

From a poor to a better than average accident record in six years — The success story of a safety program — Proves once again that safety is a way of thinking that can be implanted in all organizations

HAROLD BRUEGGING, Missouri Power & Light Co., Jefferson City, Mo.*

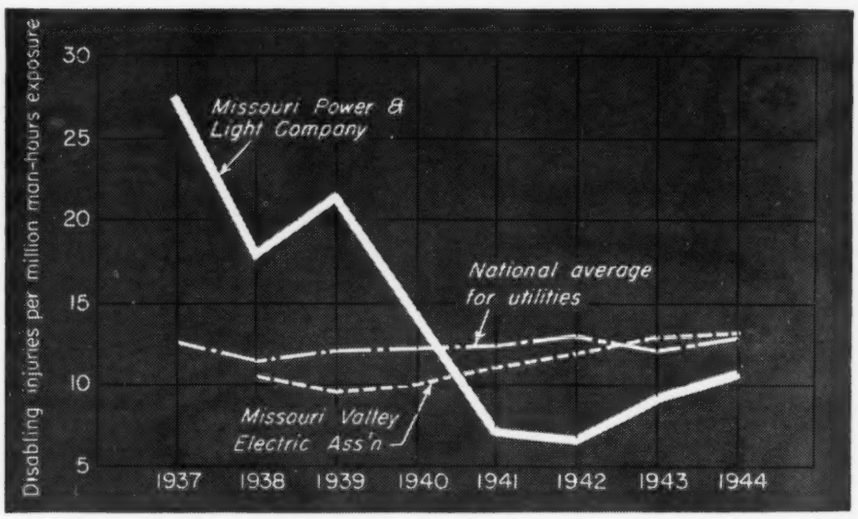
HOW Missouri Power & Light Company cut its accident frequency rate from double the national average, prior to 1939, to a fraction of the national figure in 1944 is the story of an accident prevention program grounded in the conviction that safety is a way of thinking—a pattern of thought—that can be cultivated in any organization.

In brief, our program is geared to an organization of central and local safety committees, frequent periodic committee and employee meetings, searching quarterly inspection, an annual foremen's conference, safety awards and citations.

Safety Committees

A general safety committee of five members supervises and executes the safety program. It comprises an electrical engineer, a gas engineer, power plant superintendent, distribution superintendent and chairman. This group meets monthly to examine accident trends and plan accident prevention work.

A similar local safety committee in each district, drawing its membership from each operating department: electric, gas, service, power plant and office and headed by a district safety supervisor, reaches into the basic employee classifications to achieve active participation in the program at the roots of the organization. Local committees meet monthly to discover, discuss and eliminate local hazards. Minutes pass to the general safety committee for review together with suggestions for changes in the program made at the working level.



ACCIDENT FREQUENCY DROPS—Accident frequency rate of Missouri company dropped sharply as result of safety program. It is compared, above, with national average and average of 19 utilities in Missouri Valley Electric Association

Work of the district safety committees is augmented with weekly 15-minute safety meetings conducted by each foreman to carry the program to the crews. During these meetings the men practice resuscitation, inspect tools and equipment, discuss accidents and study the company safety handbook.

Two safety inspections are made quarterly. Once each quarter a complete inspection of all tools and equipment is made by the district personnel, covering fire extinguishers, first aid and transportation equipment, and findings are reported to the general safety committee.

Following these inspections a member of the general safety committee conducts a property inspection in each district assisted by an employee from an adjoining district. This is usually done at the time of the quarterly safety meeting of each district.

These men meet with the district safety supervisor, power plant supervisor and distribution superintendent to conduct the inspection. As hazards are discovered, they are discussed with the head of the district unit and recommendations requested from him. Company policy is to have corrective suggestions originate with district personnel. This serves a double purpose: it increases the individual's interest in the job, and produces ideas from the workman's point of view. This policy, again, reflects the conviction that, to be successful, a safety program must have its roots in every section of each department so that safety becomes a manner of thinking for every employee instead of mere obedience to rules.

This quarterly inspection takes in

* Chairman, General Safety Committee, and Civil Engineer, Engineering Department.

every phase of operation and includes the power plant, storerooms, substation, shops, offices and equipment.

Take truck inspection as an example. The company operates 115 vehicles and since it does not operate its own repair depots, responsibility for each unit rests with the foreman and driver who must see that it is maintained in a safe condition. The inspection is made before the entire crew who work with the truck. Items checked are lights, horn, brakes, windshield wipers, first aid kit, fire extinguisher, tires, glass, winches where trucks are so equipped, wire ropes, tows and slings, rubber gloves, liveline tools and other safety equipment. Tools or equipment owned or used individually by an employee are inspected before him personally.

No Item Escapes

No item is too insignificant to be called to the attention of the men. It is realized that as employees become conscious of the smaller hazards and take their own steps to eliminate them, the greater obvious hazards will take care of themselves.

At a recent quarterly inspection, a lineman's belt was recommended for replacement. The district safety committee had not spotted the hazard. The lineman's waistline had increased until his belt was in the last notch and the hole showed signs of wear. Moreover, the "D" rings were no longer in the recommended location. Further inspection showed the lower strap on his climbers needed replacement and the gaffs on his climbers were too short.

District safety meetings follow the quarterly property inspection. All employees not required for duty are urged to attend, including district managers, superintendents and foremen, to add to the success of these meetings.

WINCH CABLE INSPECTED — Where wire rope is to be handled by the men, close attention is paid to conditions of the cable most likely to cause hand injuries; here it is on a truck

Presiding at the meeting is the chairman of the district safety committee.

Lost-time accidents, if any have occurred, call for a discussion with diagrams if possible. Employees are encouraged to suggest how the accident could have been avoided and steps to be taken to prevent a recurrence.

Reports to President

Following the inspection, the member of the general safety committee reports the findings and recommendations to the president of the company on a prepared form. This company officer studies the report, sends the copies to the manager of the district inspected and all participating in the inspection. The report to the manager is accompanied by a letter from the president stating that if the manager is in accord with the recommendations, he is to carry out the corrections. If not, he is to make alternate suggestions. A full report within three weeks is requested in return showing that committee recommendations or approved alternate suggestions have been acted upon and the hazard eliminated.

Quarterly property inspections constitute only one phase of the accident prevention program. We feel, however, that it is a most important one. Other phases include an annual foremen's conference, issuance of certificates of merit to districts and plants reporting no lost-time accidents, and safety award buttons to employees who have completed an accident-free year.

SAFETY COMMITTEE MEETING—Working safety committees are the core of the program. Five engineers and operating superintendents above, comprise the general safety committee that meets monthly. Similar division safety committees draw members from basic classifications in operating departments

QUARTERLY INSPECTIONS—Chairman Bruegging of the general safety committee (center) checks personal tools and safety equipment with a crew member in the field during a regular quarterly property inspection. Assisting is an employee from an adjoining district, who observes and reports to his group

Portable Test Set for Distribution Arresters

Criteria for passing on arrester based on leakage, radio noise and breakdown—Set weighs 87 pounds and tests arresters up to 8-kv. initial —Founded on 25-kv. oil-testing transformer with Variac control

W. J. STEWART, Inductive Coordination Engineer, The Ohio Power Co., Canton

A SIMPLE, dependable and fully portable test set for lightning arresters has been developed and used with satisfactory results since 1941. It weighs 87 lb. and is capable of making all three tests (leakage, radio interference and 60-cycle breakdown) necessary and sufficient to distinguish good from bad arresters. A good arrester will pass all three of these tests as detailed below.

Leakage Measurement

Leakage is determined by "voltage drop" method rather than by ammeter. A limiting resistor in the low-voltage primary supply to the testing transformer causes an abnormal decrease in secondary voltage if the leakage is abnormal. In the determination the test voltage is approximately the operating voltage and this is noted with arrester disconnected. If the arrester is good (leakage normal) the voltage will be practically unchanged; if bad, the abnormal leakage will cause a decrease in voltage reading. What is read is the drop across the resistor multiplied by the transformer ratio since the meter is calibrated in terms of secondary voltage. The leakage volt-drop should not exceed 50.

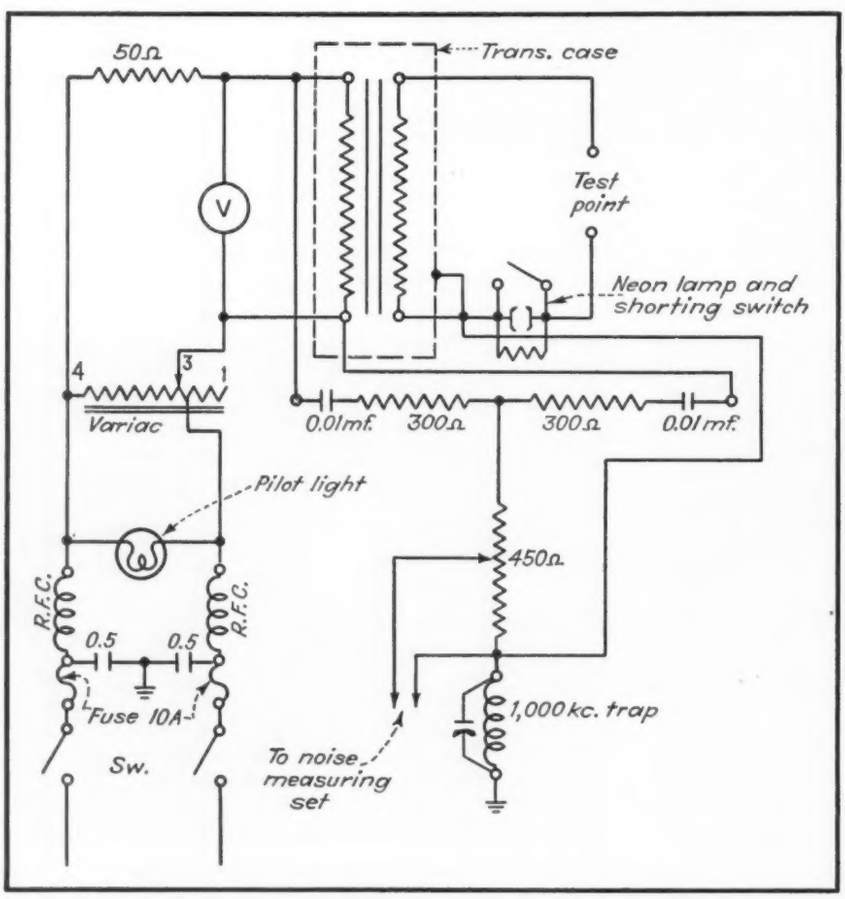


FIG. 1—Former 25-kv. oil-test transformers adapted to testing lightning arresters. Variac control gives 0-25-kv. range. Two-scale voltmeter calibrated to read secondary voltage. 50-ohm resistor gives "leakage drop." Neon lamp glows when leakage is abnormal

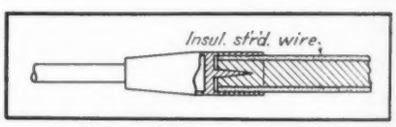


FIG. 2—Centered and pointed wire of insulated connector makes contact with strands of wire on "hot" side of arrester. A clip jumper is used on the grounded side

Placed in series with the ground lead of the arrester (Fig. 1) is a neon lamp shunted by a resistor to compensate for normal current due to capacity to ground. The lamp glows when leakage is abnormal; it gives no quantitative indication but may prove useful in field tests later.

Radio Interference Tests

Since a good arrester will not generate interference when the established test voltage is applied, it is not necessary to make quantitative noise measurements on arresters. It is only necessary to determine the voltage at which noise starts; this value should not be less than the initial test voltage.

Nevertheless, a noise meter should be incorporated in the set because it is valuable in making quantitative measurements on other pieces of equipment. An alternative to the standard procedure of coupling a noise meter through the medium of a standard capacitor-resistor network was adopted. This was done because the conventional capacitor for high-voltage work is bulky and inappropriate for portable equipment.

Instead the capacity between windings and from windings to case of the transformer were utilized for the coupling. This permits the use of a low-voltage network on the low-voltage side of the test transformer. The transformer case is insulated from ground and then grounded through a wave trap tuned to 1,000 kc., the frequency at which noise is measured. This effectively keeps the transformer case at ground potential at all frequencies except 1,000 kc. In order to isolate the noise measuring set from outside interference a filter was placed in the supply leads (Fig. 1).

For the sake of quantitative measurements the noise meter used was built around a midget radio enclosed in a copper shield; a 0—1 milliammeter is calibrated to read from zero to 5,000 microvolts.

60-Cycle Breakdown

This test consists of applying 60-cycle potential to the arrester and raising the value until gap flashover takes place. This value, as well as the action of the voltmeter, is noted. It should not be less than 1.5 times the operating potential of the arrester and not more than 4 times the arrester rated voltage. The action of the voltmeter is important to note, for a good arrester will immediately cause the test potential to lower when the flashover point is reached. Should the potential remain substantially the same when the arrester flashes over, it has usually been found that the arrester is defective and should be discarded. This action has been verified time and again by dismantling the arrester for inspection, and also by comparing this test with other accepted tests on flashover action, and has proven dependable.

In the absence of a uniform nameplate voltage rating covering all makes of arresters in each class, an initial test voltage has been established for each class tested, as follows:

LIGHTNING ARRESTER TEST SHEET

LOCATION Tiffin, Ohio DIVISION 2 DATE 8-7-45

TESTED BY H. M. Speck

MAKE AND TYPE	TEST #1 LEAKAGE "E"	TEST #2 RADIO "E"	TEST #3 FLASHOVER "E"	REMARKS
GE 9LA10A-2	0	8 KV	9.5 KV OK	OK
or Westinghouse	50	2.1 KV •	8.5 Poor •	Reject "2 & 3"
S881500 Group	400 •	2.5 KV •	9.3 KV Poor•	Reject "1-2-3"

FIG. 4—Test sheet provides data for three tests on lightning arrester

Class 1. For arresters used on 2.3-kv. delta or 4-kv. wye lines in the class of the General Electric 9LA10A-2 or the Westinghouse S881500, the initial test voltage is 3 kv.

Class 2. For arresters used on 6.9-kv. delta or 12-kv. wye lines the initial test voltage is 8 kv.

These two classes cover the bulk of the distribution arresters thus far tested with this equipment. A few arresters of higher voltages have been tested.

When the flashover voltage has been reached in the breakdown test, the voltage should be removed at once.

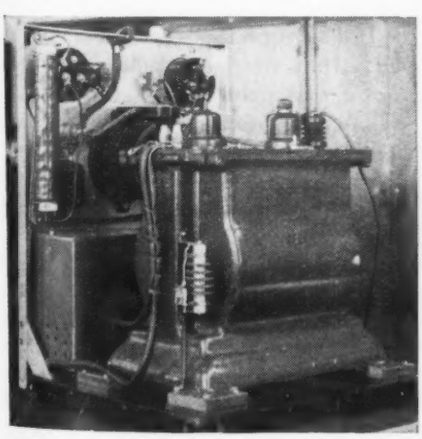
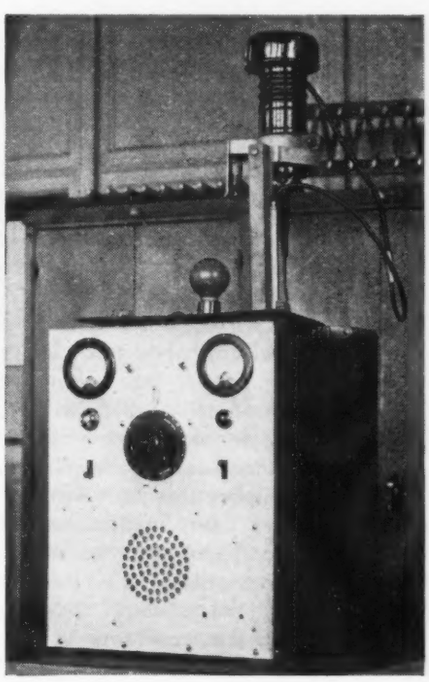


FIG. 3—Self-contained test set for distribution lightning arresters measures 18½ x 14½ x 14½ in. Stick and bracket for supporting the arrester under test are placed inside the case when set is being transported as are leads and jumpers. A lid on top is opened when tests are made; attached to it is a red warning light to indicate when the set is energized



Correction

Because of incomplete information at the time of its preparation, the article "Highlines to Happiness," published in ELECTRICAL WORLD, November 24, 1945, page 75, erroneously credited the Interstate Power Co. with production of the described farm service promotion booklet. This booklet was published by the Iowa Utilities Association as a joint project of the ten operating utilities in the state and should have been so identified in the November 24 article. It happened that the first copy of the booklet to reach the editorial desk and from which the article was written was one bearing the imprint of the Interstate Power Co. In the absence of other information at the time, it was assumed that the booklet had been produced by this company.

Latvian Plant Operating

The first unit of the Kegun hydroelectric plant has been installed, and the plant is now serving industrial plants and homes in Riga, Latvian capital.

Storage Battery Charging and Full-Floating Operation—I

Limitations of customary equipment and procedures analyzed—Numerous advantages of automatically controlled constant-voltage full-floating method of charging—Recommendations as to choice of voltage

I. F. FREED, Consolidated Gas Electric Light & Power Co. of Baltimore (Md.)*

ADVANTAGE to be obtained from the automatic full-floating operation of batteries may be summarized from the experience gained in the seven years of its application by the Consolidated Gas Electric Light & Power Co. of Baltimore.

1. The problem of the human element has been eliminated with the removal of the need for continuous regulation of battery floating by the operating personnel.

2. Automatic regulation provides a constant potential for floating batteries in both attended and unattended substations.

3. The frequency of necessary investigations of existing battery conditions and of performance irregularities has been reduced.

4. The time between visits to automatic substations has been increased.

5. Maintenance due to overcharging and undercharging has been reduced.

6. Troubles due to mechanical failures or chemical reactions are readily recognized and remedies applied.

7. Increased battery life has been realized from some makes of batteries.

8. A small crew of trained battery men care for an increased number of batteries over a larger territory.

9. Most important of all, an uninterrupted supply of current is made available for the operation of remote control and automatic protection apparatus in power stations and substations.

The battery operator's problem is two-fold: first, what is the proper charging current for the battery; and second, how can this current be controlled under all conditions?

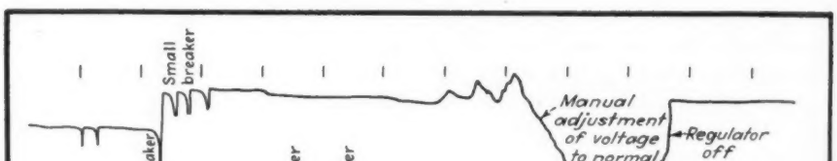


Fig. I—Record of control battery voltage with electronic regulator in and out of service

This paper reviews the factors contributing to the problems of non-cycling storage battery operation and sets up a procedure for "full floating" operation of storage batteries.

Non-Cycling Battery Operation

Floating and charging generators in many old battery installations are shunt wound and have decidedly drooping voltage characteristics. Such generators, if adjusted to any voltage value, will remain at that voltage so long as the load remains unchanged. If the voltage of such a generator is adjusted to the correct value shortly after there has been a heavy demand on the battery, the floating current exceeds the correct value due to the lowered battery voltage. This current decreases as the battery becomes charged, and the generator voltage rises above the correct setting and overcharges the battery. Therefore, in adjusting the voltage of the generator to the correct floating value for the battery, it is necessary to consider two factors: namely, voltage and current. The correct voltage for battery floating is known but at what current charge the voltage should be set has to be determined. This is not determined without considerable study and observations, hence the current factor is usually unknown.

Again, the current required for breaker operation may be so great that the battery and generator voltage may be reduced from the normal 127-129 volts of a 60-cell battery to 105 volts. Consequently, the generator field excitation is also considerably reduced. When the load is removed, the generator, upon recovering its normal voltage, must rebuild its field magnetism on an ascending excitation curve and, since there is an appreciable difference between the ascending and descending

* Assistant to Superintendent, Power Transmission Stations.

excitation curves of a generator, the shunt generator does not fully recover its voltage after an overload. This characteristic is amplified if the shunt generator has previously been floating on a descending voltage setting, in which case it may not recover its voltage sufficiently to charge the battery after a breaker operation.

After a number of such breaker operations, the generator voltage may be too low to charge the battery, although the battery may be in a discharged condition and badly sulphated. See curve with regulator off, Fig. 1. In unattended stations far from the central operating or battery maintenance groups, this is a serious problem. In attended stations, the tendency is to raise the voltage too high and overcharge the battery to correct this condition.

Voltage Variations

More recent battery floating and charging generators are designed with a flat compound characteristic up to full load, at which point the voltage drops off decidedly with further increase of load. However, this "flat compounding voltage characteristic" is not substantially constant over the entire range from no load to full load.

Furthermore in most unattended stations, the battery floating and charging generators are operating lightly loaded. Consequently, the generator brushes are lightly loaded and permit a high polish to form on the commutators and on their own surfaces. This polish tends to reduce the generator voltage below the proper floating value. Switch operation aggravates this condition in the shunt wound generators. Likewise, frequency variations on the driving motors affect the voltage settings of both types of generators.

Charge-Discharge Reactions

In addition to these problems presented by the floating and charging generators, there are those that are the natural result of the reactions which take place during the charge and discharge of the lead-acid storage cell. The sulphuric acid formed during charge in the pores and in the more inaccessible parts of the plates is of higher concentration than that of the free electrolyte outside because of the time required for diffusion. This acid concentration produces a higher counter electromotive force to oppose the charging current. Therefore, the inaccessible regions of the plate charge more slowly than the remainder of the plate and are the last to be fully charged.

So long as there is sufficient sulphated active material accessible to be converted by the current, and diffusion can take place at a rate which will prevent excessive acid concentration in the pores of the plates, the charging current will be used for the conversion of the sulphate to active material. Any excess charging current supplied merely decomposes the water in the electrolyte and causes a rapid rise of the temperature of the cell with the accompanying phenomenon of gassing. Obviously then, for proper charging, a constantly tapering-current charge is required. The value of this current is difficult to determine for lead-acid cells operating in series because of the difference in the state of charge of the various cells.

The reactions in the lead-acid battery that effect the local action or self-discharge of the plates further complicate the problem. This local action or self-discharge takes place continuously in a storage battery cell, whether the battery is charging, discharging, or standing on open circuit and may vary in different cells in one battery. It must be taken into account in determining the charging routine of a battery. Heat has an important effect on the local action of the plates of a battery increasing such discharge rapidly. Temperature differences, causing local action variations, may occur in cells due to their location adjacent to hot pipes, hot equipment, or near windows where direct rays from the sun strike certain cells.

The local action also varies with the lapse of time, with the specific gravity of the electrolyte and with impurities in the lead-acid cell. Since all cells are charged in series, the time required to charge the cell fully with highest local action may be three or four times that of the cell with the lowest local action. The necessity, therefore, exists to determine what current is required to maintain all cells in a battery fully charged without injurious overcharging or undercharging of some of the cells.

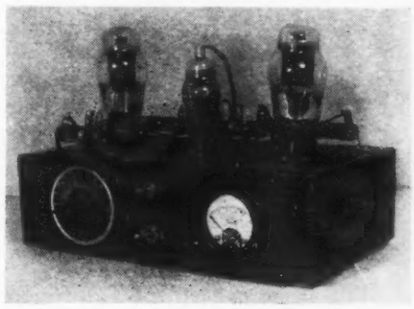


FIG. 2—Electronic voltage regulator (patented) controls voltage of battery floating generator

Selection of Operating Methods

With these various problems of battery operation in mind, the question of the selection of a method for operating non-cycling lead-acid control batteries is considered.

In non-cycling service, the batteries are maintained fully charged except for occasional momentary discharges to carry the load peaks or for emergency discharges to tide over interruptions to the normal source of current. For this type of service, two methods of battery operation are available; namely, that in which the battery is continuously connected to the load circuit while a constant current is supplied to the circuit sufficient to carry the load and, in addition, to furnish a small trickle charge current to the battery to compensate for local action and keep the battery fully charged, and that in which the battery is continuously connected to a substantially constant voltage bus or circuit.

The first method requires the determination of the amount of the current supplied. This in turn depends upon the generator characteristics and chemical reactions of the cells of the battery as well as on the variations of the load on the battery. The determination of the amount of this current would require constant observation and study of existing conditions.

Constant-Voltage Floating

On the other hand, the second or constant-voltage floating method requires that the supply voltage be kept as nearly constant as possible to prevent overcharging or undercharging. Small variations of voltage cause excessive variations in the charging rates. Thus an unobserved increase in voltage results in an excessive charging rate and produces a rise in cell temperature that causes reduction in the counter-electromotive force and further increase of current. Therefore, this

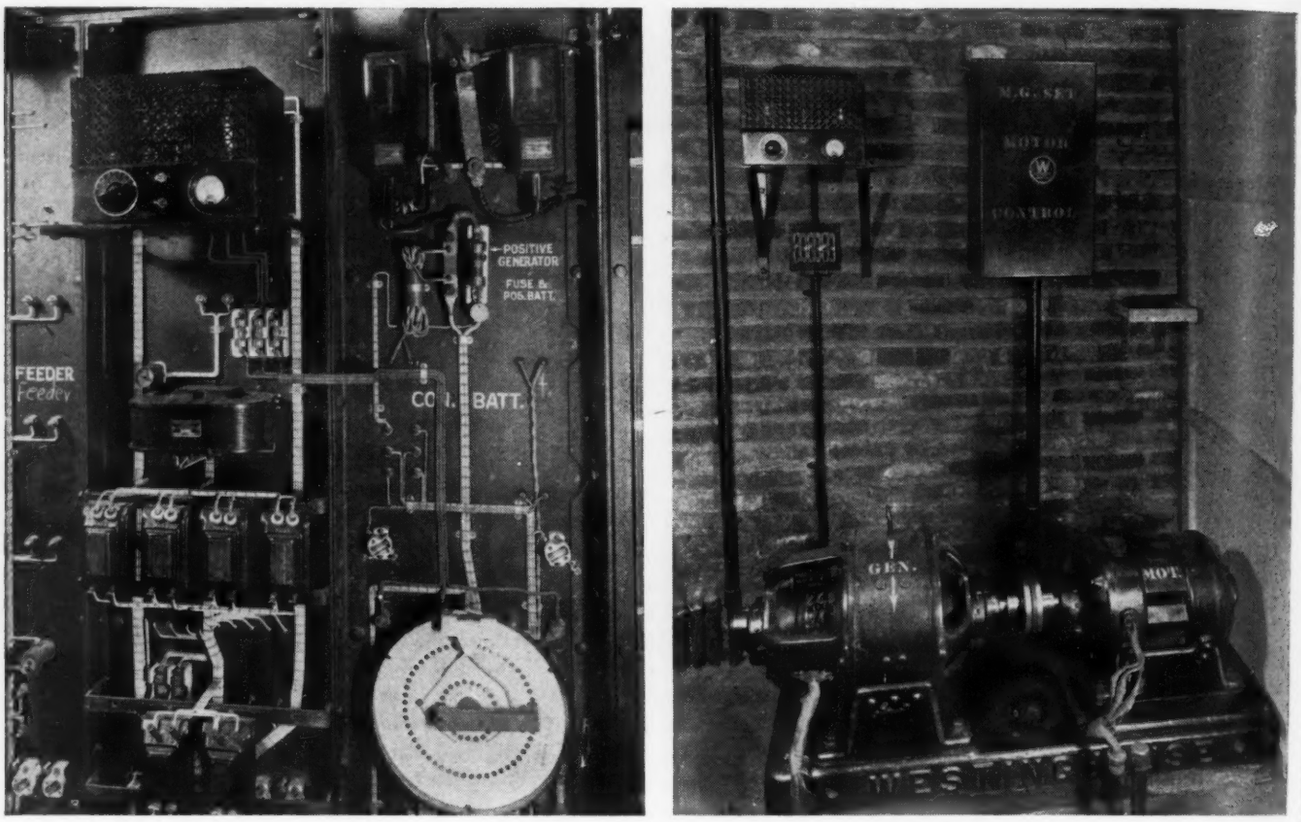


FIG. 3—Electronic regulators connected to battery-charging generators, (a—left) in attended substation, (b—right) in unattended substation

method requires that the generator characteristics be corrected.

Of the two available methods, the latter or constant-voltage floating method is preferred because:

1. It automatically compensates for the effects of varying temperatures, since at higher temperatures the battery will take more current at the same voltage, thus compensating for the corresponding increase in local action.

2. The operating conditions for the battery are independent of the load since, if the voltage of the source is not affected by load fluctuations, such fluctuations must fall on the source and not on the battery.

3. The time available between discharges in full-floating operation permits the use of lower charging rates. The lower charging rate provides a greater margin of safety and calls for less capacity in the charging source.

4. The generators for floating the battery may be designed with a flat-compound characteristic from no load to full load or they may be provided with automatic regulation.

Generator Problem Corrected

After the constant-voltage floating method of operating batteries is selected, the next step is the elimination of the variations in supply bus voltage above and below the average value. Unless the floating voltage is maintained constant by very close supervision, the batteries may be receiving either excess or insufficient charging currents for long periods of time. Both conditions result in loss or bulging of the active material of the plates, shorten the life of the plates, and greatly increase the amount of maintenance and attention normally required by a battery.

Since practical considerations make it impossible and undesirable to watch and adjust generators continuously, some other means of voltage regulation must be provided even in attended stations.

Replacement of all shunt wound generators with special flat-compound generators or diverter-pole type generators would be a decided improvement but it would be a rather expensive one. Furthermore, as previously explained, the problem created by the operation of these special generators at less than ¼ load would remain because these generators must be of sufficient capacity to recharge the batteries quickly after discharges.

Electronic Regulator

The Consolidated Gas Electric Light & Power Co. of Baltimore studied this problem with the idea of applying the proper remedy. It was decided to use an inexpensive electronic voltage regulator which was designed specifically for use with battery floating generators. This regulator was developed, patented and subsequently marketed by employees of that company. The regulator (Fig. 2) utilizes electron tubes of low current-carrying capacity. The power for operation of the tubes is taken entirely from the source to be regulated. The regulator maintains a constant voltage within ½ of 1 percent of its setting and handles capacities up to 30 kw. within the voltage range of from 105 to 135 volts or from 210 to 270 volts.

When the regulator is installed, the generator field is connected to the negative line and the field rheostat to the positive line. Three connections are required—one each from the regulator to the positive and negative terminals of the battery generator and one to the field side of the rheostat. A regulator installation in an attended station is shown in Fig. 3a and an installation

in an unattended station is shown in Fig. 3b. A portion of a chart of a battery floating with and without an electronic regulator is shown in Fig. 1.

Proper Floating Voltage

Elimination of the variations in supply bus voltage by automatic regulation of the generator voltage assures the control of the amount of current charge given to a battery. The next step is the determination of the proper floating voltage and equalizing charges for the battery.

Importance of maintaining the voltage at the proper value per cell is not fully appreciated. A voltage *near* the proper value will suffice only in so far as the temporary voltage variations above and below the correct value offset each other daily. The tabulation in the table gives the variation in current with other than the correct cell voltages, considering the normal current flowing in a fully charged cell as 100 percent, at 2.15 volts. Obviously, floating at other than the correct voltage is harmful to batteries. The question then is how to determine when a battery is floating at the proper voltage.

Floating Current At Various Impressed Voltages Across Fully Charged Cell 1.210 Specific Gravity, 70 deg. F.

Floating Current	Impressed Volts Per Cell	60 Cells
100%	2.15	129
150%	2.18	130.8
200%	2.21	132.6
75%	2.13	127.8

Manufacturers' Recommendations

It is known that with the proper voltage across its terminals, the actual current taken by a battery at any time depends on (1) the conditions that the battery has encountered prior to the time under consideration, (2) the temperature of the battery, (3) the age of the battery. Also, it is known that these variations are in all cases corrective; that is, the battery takes such current as is necessary to keep it in proper condition. The battery manufacturers will recommend the floating voltage that should be maintained for a new battery. Some battery manufacturers recommend that the floating voltage is to be maintained at an average value equivalent to 2.15 volts per cell (assuming 1.215 specific gravity electrolyte). Other manufacturers recommend average floating voltages as low as 2.13 volts per cell. These floating voltages are based on the variation of the self-discharge of the group of cells that make up the average control battery assembly.

However, the manufacturer is not in a position to prejudge the variations in floating during the life of a battery due to equipment, operating and load conditions nor to take into account the clues which indicate the condition of the battery as it ages. It is evident, therefore, that the manufacturer cannot assign definite values to the proper charging current, which might be read on an ammeter in the battery circuit. For the same reasons, the manufacturer cannot predict the proper floating voltage for the life of the battery.

Author's Recommendation

Determination of the proper floating voltage should take into account the recommendations of the battery manufacturer at the time a new fully charged battery is installed, and a procedure set up on that premise. A method used by the Consolidated Gas Electric Light & Power Co. of Baltimore for determining the proper battery floating voltage, briefly stated, is as follows:

After the battery is initially placed in service, it is allowed to float at the voltage recommended by the battery manufacturer (2.15 to 2.13 volts per cell) for the period of one month. After this time, the battery is placed on charge to determine the ampere-hours required to equalize all cells in the battery. The equalizing charge insures that every plate in every cell of the battery is brought to a state of full charge. This is especially important in the case of the negative plates. The floating voltage is then reduced to 2.14 to 2.12 volts per cell for one month at the end of which time the equalizing charge is again given.

If the lower floating voltage does not necessitate giving a longer equalizing charge, the conclusion is obvious that the higher floating voltage gives more charging current than is required by the self-discharge of the cells. If, on the other hand, a longer charge is required, the lower floating voltage is not giving a sufficient amount of charging current. This method of checking for both higher and lower floating voltages is continued until the correct floating voltage is determined. The correct floating voltage permits equalizing of all cells in the battery with the minimum overcharge to some cells and without permitting an excessive undercharge of others.

Periodic Check-up

It is not to be expected that all the plates in a battery will remain exactly alike throughout the battery life, and those that develop more local action than the rest will probably not be fully charged at the end of the normal charge. The difference, therefore, is cumulative and can only be corrected by the equalizing charge. Obviously then, the normal charge of the battery obtained by floating should be checked at intervals of six months or less in order to insure that all cells are kept fully charged with a minimum amount of overcharging.

A subsequent article will discuss the procedure in maintaining batteries in a fully charged condition.

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Rubber Brings Heat To Baby Chicks

Rubber which conducts electricity is used to keep baby chicks warm in a new type of brooder developed for poultry raisers.

The rubber is in the form of a pad less than 2 ft. square, and is made conductive by the addition of chemical compounds, according to the United States Rubber Co., manufacturer of the product.

The entire pad becomes warm, producing a radiant heat which is evenly diffused to all parts of the brooder. The temperature is kept uniform by an automatic thermostat which can be set at any desired level. The rubber company reported that the new unit consumes less electricity than other heaters constructed with coiled wire.

The technique of changing rubber from an insulator to a conductor was perfected during the war in connection with the manufacture of safety equipment to control static electricity in powder and shell plants. This equipment included conductive rubber flooring, table tops, soles and heels for workers' shoes and containers used in handling explosives. Static electricity was quickly conducted into the ground, eliminating the danger of sparks.

The material was also used during the war to heat propeller blades and the firing mechanism of guns on Army airplanes to keep them free of ice.

Heat Pump Water Heater Shows Promise

Satisfactory operation of assembly of commercially available equipment indicates possibility of combination of residential water heating and refrigeration—Advantages and economies over resistance heating seen for both customer and utility in better utilization of energy

F. M. REED, Elton, Pa.

Combination of water heating and food refrigeration and also, quite possibly, food freezing and some room cooling, all in the operation of one heat pump, looks as if it may be an entirely practicable proposition in residential electric service.

Eleven years ago the writer built a heat pump water heater for use in an office building. The installation consisted of a 50-gal. insulated iron tank, not galvanized, with a copper tube condenser coil in the bottom, and a heat pump assembled of commercially available refrigeration equipment and driven by a ⅓-hp. motor, later ¼ hp.

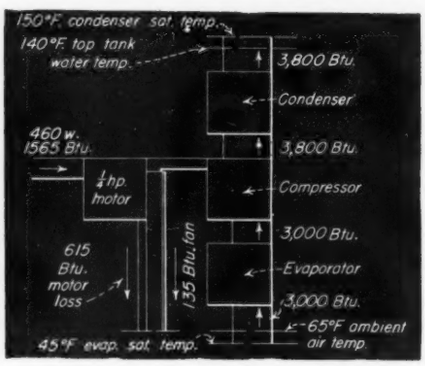
The suction side of the compressor took refrigerant from the condenser through a thermostatic expansion valve, thence through a finned evaporator which picked up heat from air forced through it by a fan on the motor shaft. The motor was controlled by a thermostatic switch operated by a bulb in the water tank. A resistance heater was installed in the top of the tank but it was never found necessary to use it. Water temperature maintained in the tank averaged 130 deg. F.; the thermostat was set for that temperature.

About six years ago the heat pump unit was moved to a house and has since supplied a family of six with all hot water requirements.

At that time, a refrigerant line was run from the condenser outlet to the household refrigerator evaporator, and one from the refrigerator expansion valve to the compressor inlet; a solenoid valve was added, with necessary control circuits, to force refrigerant through the refrigerator evaporator, when a colder temperature was required by the refrigerator thermostat. The original refrigerator operating unit was removed entirely. The one heat pump unit now operates both the refrigerator and water heater, and whatever heat is absorbed from the refrigerator is added to the water.

All equipment used in the entire assembly is standard refrigeration equipment, except the water tank and condenser coil.

The ratio of input in electric energy to output in heat, including losses through the tank insulation, for this unit is about one to two. The writer later collaborated in the construction of four other heat pump water heaters in which certain improved counterflow arrangements were incorporated. They showed a ratio of better than one to two and one-half, and one to three is well within the range of practical design. The above arrangement of refrigerator and water heater has the further advantage that the energy used by the refrigerator is a part of the input.



HEAT FLOW in heat pump water heater

Experience with this heat pump unit leads to the following conclusions regarding its advantages to the user:

The operating cost, on the lower blocks of ordinary domestic rate, for equivalent service, is less than that of the off-peak heater.

For equivalent service, a smaller tank may be used than with the off-peak heater, unless excessive operation of the on-peak unit is allowed for on the latter. This advantage varies, of course, with the charging period allowed on the off-peak heater.

In those areas where water with high oxygen is prevalent, it seems probable that a non-ferrous tank is not so essential, as the heat differential between heating element and the water is much less than with the resistance element, because of the larger surface area. Therefore, much less oxygen is liberated at the point where heating contact is made with the water.

A single unit can operate both the water heater and refrigerator, and with a duct arrangement from the evaporator would have sufficient capacity to cool one or more rooms of a house in warm weather. The refrigerator connected in this way is self-defrosting, because a small amount of refrigerant passes through the refrigerator expansion valve between cycles at the pressure of the main evaporator, thus eliminating any frost accumulation on the coils.

The maintenance cost should be little or no more than that on an ordinary refrigerator unit. This heat pump unit has been subjected to much abuse and inexpert handling, as numerous experiments in the way of changes in expansion and evaporator systems were tried,

but the original compressor ran for nearly ten years, and only broke down because the oil level was not checked when a drier was added to the system. The pistons and bearings, up to that time, did not show any noticeable sign of wear. The motor was replaced about six years ago with a smaller one, when it was inadvertently plugged in on 220 volts. The present ¼-hp. motor becomes only moderately warm to the touch during the most extensive periods of operation.

The advantages to the utility companies foreseen from the application of the heat pump principle to water heaters are many:

1. Water heating load can be obtained in competition with other fuels at regular block rates.

2. Off-peak rates need not be established to obtain this load, or if in existence need not be extended, avoiding the following disadvantages:

(a) Special metering with attendant maintenance and extra bookkeeping is avoided.

(b) Off-peak rates are frequently a fallacy if any large amounts of load are added as a result of their establishment. New peaks may be established, necessitating capital expenditures. It should be noted, in this connection, that in off-peak water heating, there are six different and not necessarily coincident peaks on various classes of equipment involved; that is, power plant, transmission lines, substations, primary circuits, distribution transformer and secondary circuits.

(c) As off-peak business continues to increase, and new peaks are established, it becomes necessary to diversify it or to leave it uncontrolled as base load. When this occurs, the off-peak rate becomes a base load rate, unable to assume its share of fixed charges and operating costs.

3. Water heating business can be obtained as base load at rates sufficient to pay its proper share of fixed charges and operating costs.

High Load Factor

4. The load requirement of the individual heater is so small, and the load factor and diversity so high, that the revenues should approach those resulting from the refrigerator load.

5. With the development and popularization of the heat pump, large quantities of low and medium temperature load, of which only unimportant fractions are now obtained by the utility companies, can easily be acquired. This is particularly true where refrigeration and heating can be produced by the same unit. Dairy farms, for example, besides refrigeration, need hot water for washing milk cans, and should be able to use this type of unit with economy.

6. If increment cost of energy should rise through increasing fuel costs, the heat pump heater on base load rates would have an increasing advantage over the off-peak heater.

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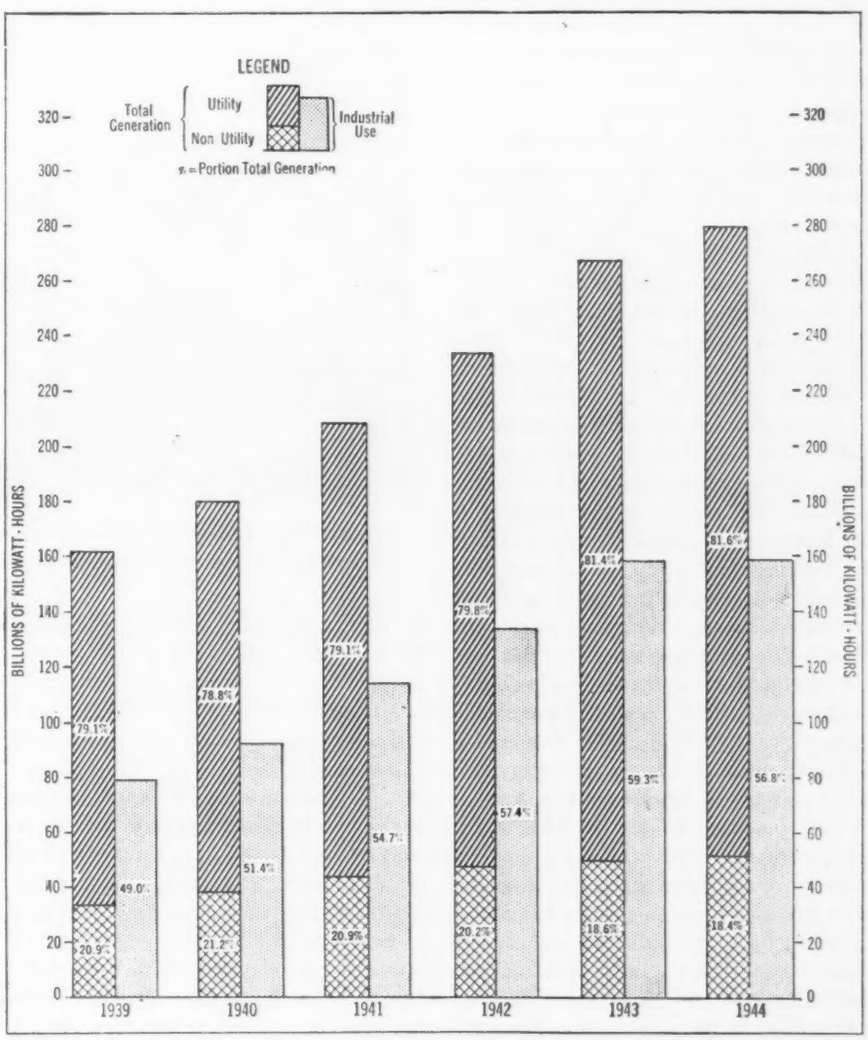
Production and Industrial Use of Electricity

Industrial use of electricity in the United States, taking the figure for 1939 as an index base, rose to 200.6 in 1943, to 200.8 in 1944, and to 209.5 in 1945, according to data published by the Federal Power Commission. Electricity production by industrials for their own use is a significant proportion of the total national production, as is shown in the accompanying graph for the years 1939-1944 inclusive.

It is interesting to note from the graph that the long-time trend of decline of self supply of electricity by industrials continued through the war period except for the year 1944. In 1939 industrials generated 42.7 percent of the electricity they used, and in each of the years following until 1944, 41.3, 38.2, 36.9 and 31.33 percent respectively. In 1944 the ratio trend turned up to 32.4 percent. Data are not yet available for determination of the 1945 ratio, and valid estimate of it is difficult, considering the war's end and subsequent industrial conditions.



Federal Power Commission

Hydrogen Gas Explosion Damages Condenser-Turbine

Reaction between clean iron and hydrochloric acid that leaked into steam side of condenser at Wichita plant during tube cleaning operations believed to be source of hydrogen that exploded, damaging condenser and turbine shell—Means of ignition not known

E. D. ST. JOHN, Superintendent of Generation, Kansas Gas & Electric Co., Wichita, Kan.

A VIOLENT EXPLOSION, apparently caused by the ignition of an accumulation of hydrogen released incidental to the acid-cleaning of condenser tubes, occurred on June 16, 1945, in the condenser of a 10,000-kw. turbo-generator at Wichita Station while the unit was down for annual overhaul. Damage to the condenser and low pressure exhaust case of the turbine is shown.

Nature of a considerable scale deposit in this condenser, accumulated during the grouting of a city dam above the plant intake, had led to the use of an inhibited acid to clean the condenser. Analysis of the scale by a chemical company resulted in their recommending use of a 10 percent solution of inhibited muriatic (hydrochloric) acid.

Acid evidently leaked into the steam side of the condenser and sufficient reaction occurred between the muriatic acid and clean iron on the steam side to form iron chloride and liberate hydrogen.

CONDENSER DAMAGE resulting from accidental ignition of hydrogen gas liberated by reaction between muriatic acid and clean iron on steam side of condenser

It is not definitely known how the hydrogen became ignited, since the steam side of the condenser was entirely closed except for the turbine-shaft seals and the steam inlet connection at the turbine throttle, which had not been made up. It may be that after a cut was made (with a cutting torch) in the line used to fill the condenser with acid, sufficient gas of the correct mixture remained at this point to maintain combustion and that the flame followed back through this pipe to the water box and through the opening that had allowed acid to leak into the steam side of the condenser. The cutting torch was not used in the proximity of the throttle valve connection or the turbine shaft seals.

Avoiding Recurrence

To prevent similar occurrences it is recommended that:

1. The steam side of the condenser always be filled with water above the level of acid added to the water side of the condenser. Should a leak develop it would then not be possible for acid to leak into the hotwell.

2. The condenser should be adequately vented to the outside of the building at a point where there is no chance of igniting any combustible gases coming from any of the vents.

3. At no time during the cleaning process should the condenser or any connections be opened to the atmosphere.

4. All sources of ignition would be carefully watched and kept away from the condenser.

5. After acid has been drained from the condenser the vessel should be purged before opening for inspection.

Further appreciation of the significance of these precautions may be gained from a full recital of circumstances surrounding this occurrence.

The condenser involved is a two-pass

design. It differs from the conventional in that it is set off to one side of the turbine. The steam inlet to the condenser is on the side at a 15 degree angle from the horizontal. A large exhaust nozzle and ell extends from the condenser opening to the expansion joint below the turbine exhaust flange. The condenser and exhaust nozzle were of cast iron and originally contained 25,000 sq. ft. of cooling surface made up of one-inch, 18 BWG tubes, 18 ft. 2⅝ in. long. Several years ago the cooling surface was reduced to 18,850 sq. ft. in relining the condenser.

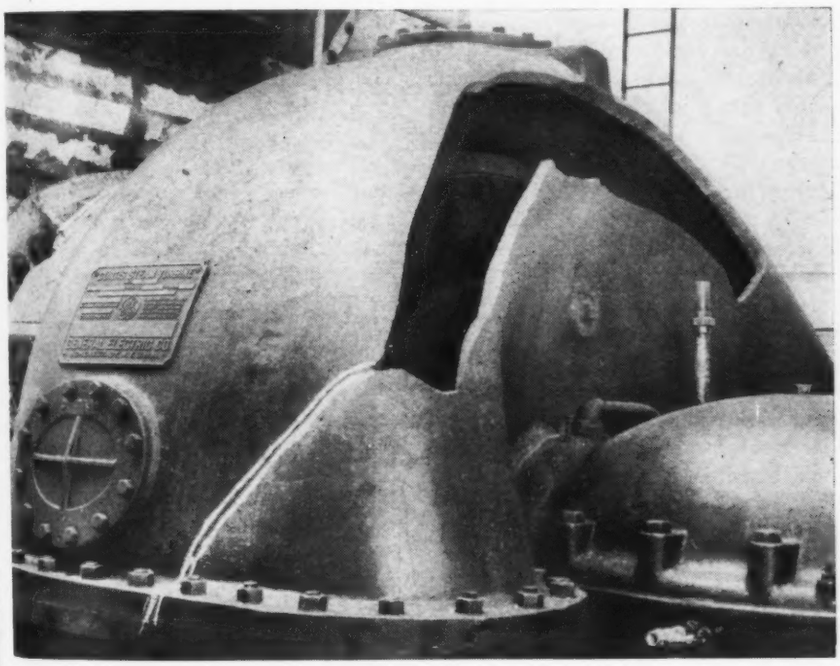
Slightly over 5,200 gal. of solvent was required to fill the water boxes and tubes. This was purchased from a chemical company and pumped direct from their truck into the condenser. After completing the installation of the acid, the chemical company crew was not to remain until reaction of the scale was completed.

Previous to installing the acid, 2-inch vent lines were laid from both water boxes of the condensers to the outside of the building through a common 4-inch line. To provide for circulation for the acid and avoid the tendency of the tubes to become gas locked, a 5-inch centrifugal pump was connected temporarily to the drain on the inlet water box. The pump discharge was connected to the other pass of the condenser. Thus the acid was circulated through the two passes.

Preceding Events

The acid was installed from 8:00 a.m. to 1:00 p.m. on June 15. The strength of the acid was tested at about 20 minute intervals. At 2:45 p.m. the acid tested 7.2 percent and still tested this amount at 5:00 p.m. Since strength of the acid was not being reduced as much as expected, the chemical company recommended that it be left in the unit over night. At about 7:30 p.m. the operator found acid in the hotwell. This indicated a leak had developed in the condenser. By morning the level of the acid in the water boxes had dropped below the top manholes. The manhole on the outlet end of the condenser was opened for inspection at 9:00 a.m. Tubes appeared to be clean and reaction of the acid had practically subsided. The water box was closed and arrangements were made to remove the acid.

Temporary piping used to install the acid was connected to the condenser at the same point as the discharge from the temporary circulating pump. This discharge line was disconnected with wrenches, leaving the end of the tee next to the water box vented to atmosphere. The side outlet of the tee was connected to the line which had run from the truck and, since this had been welded in place, the section at the turbine room floor elevation was being removed with a cutting torch. Two cuts had been made in this line and just after the third cut was completed the explosion occurred at 2:48 p.m. Vent lines on the water boxes were still in place and open to the atmosphere.



TURBINE EXHAUST HOOD showing hole and crack produced by hydrogen explosion

Explosion Damage

The explosion was most violent in the exhaust nozzle of the condenser, which was completely wrecked up to the expansion joint. Also wrecked was the condenser shell adjacent to the exhaust nozzle connection. Water boxes, tube sheets and tube supports of the condenser were not damaged, and there was no indication of any explosion taking place in the water boxes of the condenser.

Also damaged was the low-pressure end of the turbine exhaust case. A large section in the middle of the top half was blown out. Cracks extended from this opening down to the horizontal joint on both sides. The atmospheric relief valve was also damaged by the explosion, which forced the disc up through the bonnet, breaking the lower guide on the disc. The explosion ruptured the piping over the top of the condenser, allowing steam to come in contact with the acid. Considerable difficulty was encountered in getting the steam shut off due to steam and acid fumes in the basement. Damage was also done to the generator air ducts because of blowing in a partition in the basement adjacent to the exhaust nozzle. The turbine room floor over the condenser was ruptured and the concussion damaged the skylight in the turbine room roof.

Two other units in the station were in operation at the time of the explosion. A large piece of the turbine case struck the throttle valve on one of the units, causing damage to the yoke of the valve and shutting down the unit. The other unit remained in operation carrying full load all during the trouble.

To repair the condenser, it was necessary to install a complete new shell and exhaust nozzle which was fabricated from steel plate. The damage to the turbine exhaust case was repaired and the unit was returned to service on August 27.

Northwest Power Pool Reservoir Operation—II

Policy of refilling reservoirs, points agreed upon in storing energy in another's reservoir, spilling stored energy, bottlenecks and allocation of reservoir draft are discussed along with limitations encountered

E. N. PETERSON, Ebasco Services Inc.

OPERATION of 21 reservoirs representing two and three-quarter billion kilowatt-hours in the four million-kilowatt, five-state Pacific Northwest Power Pool has required painstaking effort and a conciliatory spirit among operators of the huge eleven-utility interconnection to achieve maximum utilization of resources of the pool as a whole. In a previous article some of the basic philosophy of reservoir operation was given and the rules governing reservoir operation were discussed. This article will begin by taking up further discussion of rule 7, covering refilling reservoirs.

This rule states: "Rule curves" shall provide for refilling the reservoirs by July 1 on the basis of the lowest recorded runoff during the filling period. After the drawdown period, reservoirs shall be refilled in accordance with this rule except: a, when minimum generation fails to bring the reservoir up to the curve; b, where water conditions can be predicted to be assured of filling later; and, c, when steam generation is necessary to provide the energy to fill the reservoir.

Needless to say, a full reservoir is of great value at the beginning of the drawdown period. For that reason conservative operation requires that every effort be made to have the reservoirs full when the drawdown period begins, and the rule curves are prepared to accomplish this. Actually, though, no calamity would result if some reservoirs failed to fill. In fact, in a number of cases filling every year may not represent most economical operation. So this rule is over conservative and studies are under way to modify it.

Conversely a full reservoir at the end of the drawdown season is generally worse than useless. It represents energy that might have been used but wasn't, perhaps fuel that was burned needlessly. It also fails to provide a "hole" for the spring floods which may cause damage downstream. A full reservoir in March may be a distinct liability.

It is perhaps natural for an operator to feel that being above the rule curve is like an anchor to windward and has some strategic or financial value. But this is rarely true. Such incremental energy has value only to the extent it is used. Unlike an earlier illustration, procrastination in this case does not pay. For this reason it has been agreed that water above the rule curve is surplus. The accompanying chart shows the reservoir rule curves for 1945-1946.

It must be evident that the operation of reservoirs in accordance with the principles set forth involves some waste in an average water year. Being constantly prepared for critical water which never occurs (or hardly ever) is costly. Economics dictate an early draft on reservoirs before the rains which generally come in the late fall make the storage less valuable. Prudence on the other hand requires holding on to this resource which becomes so vital if the fall rains do not materialize. As a result, a portion of the storage remains unused. What the Pool could do with a crystal ball!

When the management sees stored energy wasted over the spillways year after year, energy which often has been purchased and represents large sums of money, it is apt to cast a critical eye on the friendless system operator. The operator himself may feel a little guilty when he thinks of all the money he might have saved. But this should not be so. After all, the amount of stored energy normally wasted is but a small percentage of total energy requirements. Insurance premiums are usually wasted too, but people continue to carry insurance.

Storing Energy in Another's Reservoir

When water is spilling past a plant which is not operating at full capacity, that represents a waste. If at the same time there is a reservoir with a "hole" in it, that provides an opportunity. Stopping the waste and storing the otherwise lost energy in the hole for future use, that is economy.

Suppose A has surplus hydro energy which he wishes to store in B's reservoir. After the necessary conditions have been discussed and agreed upon, a schedule of interchange is set up whereby A carries a portion of B's load and B backs off on his generation by reducing the draft on the reservoir where the storage is to be effected. This obviously results in a higher reservoir elevation than if the transaction had not taken place. The amount of energy delivered by A to B represents the energy stored for his account in the reservoir. This amount may be subject to correction for line losses, plant losses due to less efficient operation, evaporation losses and other factors previously agreed upon (see tickler list).

In some storage transactions, the owner of the reservoir has first call

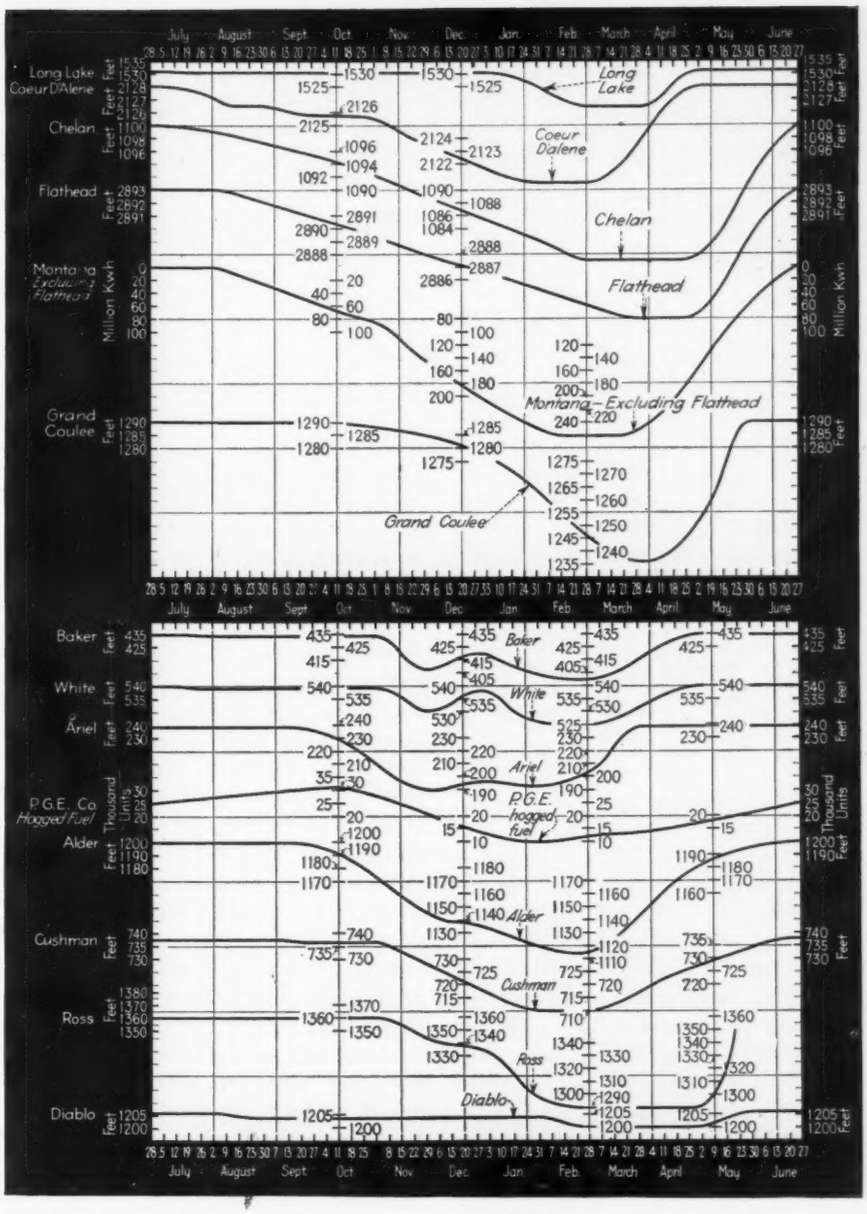
on all the energy stored therein. If he wants what A stored as illustrated above, he takes it and pays A the stipulated price. Under this arrangement A does not know whether or not he can get the energy back later if he needs it. Other systems give prior call on the stored energy to him who first generated it, viz., A in the above illustration. This gives A "something in the bank" that he can draw upon if things get tight later on.

Suppose it rains, and it usually does, and the above reservoir fills and threatens to spill. In such case B notifies A that he must take delivery of his energy or lose it. If A has plenty of water too and can find no buyer he probably elects to lose it. Naturally the reservoir owner spills the other fellow's energy first. Life is like that. This looks as if A got the short end of the deal. He supplied B with energy to carry part of B's load and got nothing in return but a lot of complicated bookkeeping records. But that is not the whole story. The stored energy was insurance, a nest egg to be used later when and if critical water conditions occurred. If good water occurs, he has paid his premium without the need to collect the insurance. B on the other hand got nothing out of the deal either. The extra water stored in his reservoir shot over the spillway on its way to the sea without turning a wheel.

Postponed Wastage

But A received another benefit, a benefit which accrued as well to the whole Pool. At the time the storing took place, A had the alternative option of wasting the water past his plants. Instead he elected not to waste it then but to hold it a while at the risk of possible, even probable, waste later. The wastage was postponed and it *might* not have occurred. Instead it might have proven to be a life saver if the rains forgot to come. B's reservoir made this timely conservation of energy resources possible.

The question as to who will pay for the energy A stored in B's reservoir is not always easy to determine. A naturally hesitates to generate and deliver power without getting paid for it. On the other hand, B is reluctant to buy energy for which he has no foreseeable need. Such a transaction can of course be handled through a suspense account providing for the ultimate disposal of the stored energy when and if the future need for it arises. But the question as to who pays and when must be answered equitably to both sides, or else the surplus hydro may be wasted over the dam and the hole in the reservoir may continue to yawn.



NORTHWEST POWER POOL reservoir rule curves 1945-1946

Spilling Stored Energy

When a storage reservoir begins to spill, various arrangements are made as to the sequence of spilling stored energy. Where several outsiders have storage in the same reservoir, their respective ownerships are conveniently considered to be in "layers" in order of priority. The lowest priority energy is the top layer and goes over the spillway first. Relative priorities are known before storing begins. The owner has first priority to the use of his reservoir (though not always to the energy in it). The priorities of others may be determined by existing contracts, by the relative sequence of storing (i.e., last in, first out) or by verbal agreements. Where the owner of the reservoir has retained the right to acquire all energy stored in it, price tickets are generally tagged onto the various layers of stored energy. In such case the highest price energy is on top and is sacrificed first. This might be considered bad housekeeping until one remembers that the reservoir owner, having first call on the stored energy, naturally wants to pay

as little as possible in case he elects to buy it.

A typical use of reservoirs is for inter-system load factor operation. Utah has hydro peaking capacity in its Bear River plants. In order for the Pool to make use of this peak resource, Utah has delivered on-peak energy for use in the Western systems, receiving compensating energy during off-peak hours. This means that Utah's Bear River ponds are drawn down rapidly during the peak and are refilled during the night or over weekends. In this manner Utah has actually been an exporter of peak and an importer of energy over the same period of time. A somewhat similar transaction has occurred where Utah was short of day energy but had surplus off-peak steam capacity. This excess steam energy was transmitted to Montana at night and stored in its reservoirs. During the day Montana drew out this stored energy and returned it to Utah to help carry Utah's peak load.

Tickler List

Mention has been made that conditions under which energy is stored are discussed and agreed to "a priori." This is accomplished by using a "tickler list" of items to be discussed by prospective contracting parties before agreement to store is made. This list is the result of some false moves, misunderstandings and headaches due to failure, in the earlier years, to consider all of the elements involved. The number of items is surprisingly large and an abridged list of them is given below.

1. Name of reservoir in which energy is stored. Normally this is the reservoir that would have been drawn upon but wasn't because of the storage transaction with the outside system.
2. Amount of storage already in reservoir for account of others.
3. Priorities on storage space in reservoir.
4. Factor to be used for converting energy accepted for storage into volume of water stored.
5. Factor to be used for converting stored water into energy delivered from storage.
6. Conditions affecting the return of energy stored, e.g., time of year, time of day, whether on or off peak, etc.
7. Priorities on getting energy out of storage in case lack of excess generator capacity makes it impossible to deliver simultaneously the requirements of several systems.
8. Reservoir owner's expected operation of reservoir in relation to rule curve.
9. Factors affecting spilling such as reservoir elevation, risk of flooding lands, loss of flashboards.
10. Possible corrections for increased evaporation and increased operating head resulting from stored water, also corrections for operating generators at inefficient loadings.
11. Toll charges for storing and redelivering energy for another system.

As times goes on this list may be lengthened still more but in its present form it covers fairly well conditions encountered in the Pacific Northwest.

Bottlenecks

Bottlenecks are the bane of pooled operation. As soon as one bottleneck is overcome, others appear and perspiring system operators are faced with bottlenecks at every turn. So, in the matter of storing water for some other fellow's account, bottlenecks play the villain's role. First in order come the transmission or interconnection bottlenecks. If B is scheduling a heavy importation into his system for current operations, his interconnections may be loaded to capacity and in such case he is unable to receive more energy from the outside for storage purposes. It will be necessary then to limit storage transactions to off-peak periods when his immediate needs for outside power are smaller.

Similarly A may be loaded up to his full generating capacity during on-peak hours and be wasting water the rest of the time due to lack of load. In such case his storage transactions with B must necessarily occur at off-peak hours. But here another complication often occurs in that B may have run-of-stream plants which he cannot shut down at night in order to accept outside energy for storage. If his off-peak load is not greater than the output of these run-of-stream plants, no storing is possible. Since the energy stored is really in the form of water and is generally measured by a rise (or a reduced drop) in the reservoir elevation, it is self-evident that storage cannot go on at a faster rate than the inflow of water into the reservoir. This, however, does not apply where existing storage merely changes ownership.

Come now more bottlenecks to plague when the stored energy is to be delivered back to A, its owner. If A wants it on peak, B must have spare peaking capacity over and above his peak needs to deliver the energy at that time. If he has, there must be enough spare transmission capacity to transport this increment over and above other line loads. If he has not, A will have to take delivery of the power off-peak and this he can do only to the extent his off-peak load exceeds his uncontrollable hydro. There are many other and more subtle bottlenecks affecting pooled operation and some of these will be discussed in a subsequent article.

Allocation of Storage Draft

It has been stated that the allocation of the total reservoir draft among the available reservoirs should be done on some equitable pro-rata basis. This is true in theory but wide deviations from this simple labor saving method are necessary. The rate at which an individual reservoir can be or should be drawn depends on many conflicting factors only a few of which are mentioned here.

Reservoirs located in areas of heavy December rains must be emptied early so as to catch such rains. Others such as the upper Missouri River plants must be kept full longer to avoid serious loss of head and resulting reduction in peak capacity. Others must be kept full to insure having enough resources for a possible January and February drought. Still others like Flathead must be drawn upon at a uniform rate to insure maximum over-all output. It is all very confusing.

Limited Machine Capacity

Limited machine capacity affects reservoir operation and this is sometimes quite a headache. It is painful to pull down a reservoir faster than the water can be put through the turbines and have the potential kilowatt-hours go to waste over the spillway. And yet at times it is right and proper so to do. For example, below the Hebgen reservoir on the upper Missouri River system in Montana, there are eight hydro plants in series which receive the benefit of Hebgen storage water. These plants, built over a long period and under various economic

conditions, have different water capacities. Discharging water enough to load up the large plants necessitates wasting water over the spillways of one or more of the smaller ones. This is wasteful and painful, more so in a normal than in a critical water year. On the other hand, limiting the flow to the smallest capacity plant on the river means that the big plants must operate below capacity. That too is wasteful. Furthermore, such operation fails to empty the reservoir and, when the spring rains come at the end of the drawdown season, we find ourselves with a large resource which immediately becomes unusable, unsaleable and irrevocably lost.

There are other cases where it is necessary to divert storage water past hydro plants due to limited machine capacity. Grand Coulee is one. With the Grand Coulee plant fully loaded, storage water is discharged over the spillway and travels down the Columbia River on its 450-mile journey to the Bonneville plant. Naturally the increased load, which necessitated releasing this added storage water, cannot wait three or four days until Bonneville can step up its output. So the slack is taken up by temporarily drawing other Pool reservoirs below the rule curve.

In establishing rule curves for individual reservoirs, the tentative aggregate storage draft for the Pool as a whole must be allocated with due consideration for the many limiting factors involved. Of course before any allocating can be done, the inflexible and non-controllable items must be separated from the total. This deduction made, the balance, composed of items containing varying forms and degrees of flexibility, is prorated among the individual reservoirs. But such prorating will result in some reservoirs being drafted at too rapid a rate for the installed capacity, or not rapidly enough to empty the reservoir in time, or at a rate not in harmony with license requirements.

Compensating Drafts

So, adjustments are made to take account of all this. Naturally if the draft is reduced on one reservoir in any month it must be increased on that reservoir some other month in order to use up all the storage. Also, reducing the draft on one reservoir in any month necessitates a corresponding increase in draft on others in the same month so as to maintain the total storage required that month. It's like juggling three balls plus a couple of chestnut burrs.

From this and the preceding article it must be evident that operation of the 21 reservoirs of the Pool to obtain maximum utilization of resources and greatest economic good for the area as a whole is a complicated problem. Yet it is one whose economic significance is so great that it warrants most painstaking study and operating supervision. A subsequent article will take up the operating program for the Pool, another important phase of large-scale integrated system operation.

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Mechanization Speeds Manhole Cleaning

Cleaning manholes in Chicago is a mechanized operation. It has to be! There are 22,000 manholes on the underground system of the Commonwealth Edison Co. The schedule calls for a complete city-wide cleaning about once every two years. Downtown "loop" district manholes are usually cleaned annually. This schedule just doesn't allow "bucket and rope" methods of removing debris or off-hand methods of unwatering.

The job is done with four special manhole cleaning trucks operated by the company's conduit division. Each truck and its crew of four men clean between 15 and 20 manholes per day depending on how many have to be pumped out and also on the amount of muck. Trucks are modern cab-over-engine vehicles with a double or five-man cab and dump body capable of holding about three yards of debris. Weight of the trucks is 17,300 lb. and they have a 9,000-lb. load capacity.

Equipment

Pumping and hoisting, incidental to cleaning, is done by pneumatically driven equipment. Each truck has a 105-cfm. air compressor driven by the truck engine through a power take-off. Two turbine-type pneumatic sump pumps rated 200 gpm. at 25-ft. head are provided on each truck; one pump is a spare. To unwater a manhole the sump pump with its compressed air supply line and water discharge hose is lowered into the hole. Water is discharged into the gutter or an adjacent storm sewer opening. In addition to the sump pumps two of the newer trucks have a centrifugal pump mounted on the front bumper and driven from the shaft of the truck engine. This pump is rated 265 gpm. at 20-ft. head.

Debris is hoisted from the manhole in a special drop-bottom bucket of 2⅔-cu. ft. capacity that is suspended from a simple crane on the rear left corner of the truck. The bucket is raised and lowered by a compressed air hoist controlled by an operator standing on the ground at the rear of the truck. A simple ring gear and crank-operated pinion on the crane swings it inboard so that the bucket can be dumped by triggering the latched drop bottom.

Loading of the hoist bucket is still done by hand by a man with a shovel in the manhole. Nevertheless the air-powered hoist has taken much of the heavy hauling out of manhole cleaning. The power hoist has permitted use of a large capacity bucket contributing to better working efficiency. Without a hoist, speed of cleaning is limited by the size of bucket that one man can haul up from a manhole by hand and dump up over his head into the truck.

MANHOLE CLEANING TRUCK equipped with pneumatic sump pumps and air driven hoist for removing debris cleans up to 20 Chicago manholes daily. Pneumatic sump pump, at right above, has just been removed from manhole. Men are preparing to lower drop-bottom bucket which has 2⅔-cu. ft. capacity

Editorials

S. B. WILLIAMS, *Editor*

Wind Power as Standby for Hydro

GRANDPA'S KNOB experimental wind power installation was a victim last year of the very elements it tried to harness, but it cannot be rated as a failure, for out of it came the test data and information needed before proceeding on a practical basis. It is now known that commercially usable power can be produced from the winds, and with what degree of reliability and availability. Other data, such as site location, height, optimum size of installation and spacing, as well as structural details, came out of the experiment. It has not yet been determined if wind power can be made competitive with fuel power but the indications were sufficiently favorable to warrant plans for the erection of a plant on a commercial basis.

If costs can be brought down to somewhere between $100 and $150 per kilowatt then there is every indication that wind power, at least in the northern New England area where dams are modest in size, will prove to be a satisfactory standby for hydro in competition with steam or power now purchased for that purpose. The characteristics of wind power in that location are such that its time of maximum output comes when hydro plants are in greatest need of assistance. And since wind plants can be automatic, the cost of operation can be kept low.

Wind power like water power has its seasonal variations and therefore cannot be depended on alone to supply dependable service to the maximum of its capacity. However, when its availability curve complements that of hydro, it may prove to be a power tool of considerable merit, particularly if the unit investment can be brought near that for fuel plant.

Because of plant size limitations, 2,500 kw. in the present location, the possibilities of lowering cost per unit through increased size are not present. Offsetting this, however, is the favorable factor of low-cost plant site. Structurally, the plant is expensive per unit of capacity, but here again is the offsetting factor of cost of fuel handling and processing, as well as condensing water in a coal-burning plant.

The possibilities for the use of wind power as a part of a coordinated power supply system have stood the test of engineering experiment. If they stand the practical test of economics, we shall have added one more tool to our power supply kit.

Buried Cable for Residential Service

LOW COST UNDERGROUND SERVICE for residential districts, which has been talked of for many years, is getting closer. Wire manufacturers are now confident they have buried cable designs that will meet service requirements at prices low enough to be attractive.

Initially, buried cable will probably find its greatest use in new housing projects where the cable can be laid before grading. However, there is no reason why it cannot later be used in older areas when more is learned about inexpensive installation methods.

Opinion seems to be divided at present as to locating lines along the highway as is present overhead practice with so many companies or along the back lot line. There is much to be said for both and the reasons that can be advanced for overhead decisions are not always equally valid for underground. Both will probably be tried out.

Also, there are differences of opinion with respect to transformers, the prevalence appearing to be in favor of partially buried, at least enough to bring in the cable below the surface. From the standpoint of appearance and safety, there is argument in favor of fully buried transformer vaults but that practice imposes several disadvantages, such as additional costs and lessened capacity due to poorer ventilation. Partially buried transformer housings, on the other hand, can be designed so that they are neither ugly nor hazardous.

Low cost underground is but another effort to protect service against outages due to acts of God. There are still a lot of questions, such as fault location and repair, that need answers which will be found not in opinion but only in actual practice. The new program for erection of hundreds of thousands of new residential units should offer an opportunity to gather facts.

Appliance Servicing Programs Important

DURING THE WAR utilities generally directed appliance repairs to the trade and, considering the difficulties in getting parts and labor, the job on the whole was not badly done. What was good enough during the war, however, when people had schooled themselves to have patience, will be a long, long way from being acceptable during normal peace times.

Before the war appliance repair service left much to be desired and the same will be true again unless meas-

ures are taken promptly to see that service shops are at hand that will do good work for reasonable prices. There is no good reason why utilities should handle appliance repairs except to enable the customer to use service. Repairs to customers' appliances in themselves are not profitable to a utility, and frequently are a headache.

While the trend in design is constantly toward making appliances less and less needful of attention, there are also more equipments of a more complicated nature coming on the market. Furthermore, the expansion of home electrification is making people dependent upon electricity to a degree where equipment service must be prompt and reliable.

Whether certification, which seemed to work well in some places before the war, or some other plan is devised, the trade, manufacturers and utilities, because of their common interest in consumer satisfaction, must act together wholeheartedly to make the plan work.

Some Effects of Lower Yields And Rising Costs on Return

LAST WEEK a new utility bond issue carrying a 2.5 percent coupon was offered at a premium to yield 2.39 percent, or less than the offering yield of long-term coupon bonds sold by the government in its last Victory Loan campaign.

While this is the lowest public offering price on record for a private utility, there have been offerings in the last year at yields of less than 3 percent. Where does this trend lead?

Already the trend toward lower money rates, which has been going on for several years, has led to a gradual reduction in the rate of allowable return. Investors are now buying stocks in the open market at dividend yields below the rate of return allowed in fixing rates in a great many instances and it is therefore reasonable to expect that this condition will be taken into account in future rate determinations.

Already there is some indication that state commissions will review the effect of repeal of excess profits taxes on earnings and, while a case can be made out for the contention that the term excess profits as applied to regulated utilities was a misnomer, there will be a strong urge to find a way to give the consumer a large part, if not all, of the amount formerly paid as an excess profits tax. It is not at all unlikely that current yields on utility securities will be ignored in reaching a decision.

On the other hand, commissions that are as conscious of their responsibility to the investor as to the consumer will realize that too close an adherence to cost of money in setting return may be unfair to the investor in a period of inflation. Rapidly rising costs must be given very careful consideration and any decision, therefore, should be heavily in favor of seeing how high a return can be allowed instead of how low, at least until there is an indication that the cycle of inflation has run its course.

Farm Lines Need Adequacy and Reliability Studies

AS FARM AND RURAL USAGE of electricity grows, more and more questions relating to farm line adequacy and reliability will be raised. It must not be expected that the farmers can be persuaded to depend upon electricity as the universal farm hand unless there goes with it an assurance that the lines and equipment will have ample capacity and will be so engineered as to minimize outages.

One of the foremost problems at the present time is the size of transformers used on these lines. Efforts have been made to get manufacturers to design units of less than 1-kva. rating. These will be sufficient to take care of lights and small appliances but are entirely inadequate to handle the farm commercial load. There is no economy in their use if there is any indication that the farmers served from them expect in time greatly to step up their usage. In fact, very small transformers may serve as a deterrent to increased use.

So important is this subject of size and characteristics of rural transformers that a comprehensive analysis of the subject from all angles including needs, trends, costs and long-term economics should be made just as soon as possible.

In some sections of the country farm chores require motors larger than the line was built to carry. For a long time it was felt that a 5-hp. general-purpose motor was large enough to take care of virtually any need that might arise on the farm. That practice is now being questioned and, according to reports, is being used to good advantage by the tractor industry. Analysis of farm needs and farming methods can be used in this connection.

Many farm lines, built with an eye to economy in the belief that revenues would be insufficient to carry strongly built lines, afford too little protection to users who would lose heavily if the current failed for any appreciable length of time. In such cases first-cost economy may prove to be a far greater luxury in the long run than the higher cost, but more sturdily built, lines. Therefore, before farmers become too dependent upon electric service it would seem advisable to study the economics of this situation also, including modern methods for strengthening already built low-cost lines, possibilities of gridding or sectionalizing to restrict outages and even the practicalities of buried cable.

Some, if not most, of the suggestions that will come from such studies may not be practical at the moment either because the equipment is not available or is too costly to install at this stage of the art. Nevertheless, the farm program is moving along too fast to wait for difficulties to arise before preparations to meet them are made. Even if analyses made today did nothing more than uncover the requirements, they would more than pay off in the stimulus they would give to research to find practical solutions.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

A New Subsidy for Government Power

THE MODEST CONFINES of the House Irrigation and Reclamation Committee harbor a highly technical dispute which has a tremendous potential effect on the electric power industry in terms of competitive possibilities.

When Congress, in 1939, passed the Reclamation Project Act, it thought it was enacting legislation requiring, among other things, that the revenues from hydroelectric power generated thereunder be sufficient to amortize all project costs allocable to power, plus interest thereon at 3 percent annually.

Interior Rejects Amortization

In 1944 and 1945, however, there were issued by the then solicitor of the Interior Department, Fowler Harper, opinions holding that power revenues from projects governed by the Act must be sufficient to meet either of two minimum standards. These are:

1. Power revenues by projects must be sufficient to return all costs which are assigned to be returned by commercial power, plus the stipulated rate of interest (3 percent) on that part of the project cost allocable to power.

2. Power revenues must always be sufficient, by projects, to return, in perpetuity, 3 percent interest on project costs allocable to power, plus sufficient other revenue to pay off, in 50 years, other charges which the Interior Secretary may decide shall properly be chargeable to power. (It was held unnecessary ever to amortize power costs so long as 3 percent interest thereon be returned by the power revenues.)

Before going further, it should be understood that Interior has not yet attempted to apply the second formula for power revenues.

The opinions advanced a second new concept—that the 3 percent interest on reclamation project costs allocable to power should not go into the Treasury general fund to cover the cost of the money which the United States borrows to finance the irrigation projects, but rather that it should be applied to the cost of the irrigation features of a project, some of which invariably must be repaid not by water users but out of power revenues.

When the First Deficiency Bill sped through Congress shortly before Christmas, an attempt was made—unsuccessfully at the time—to outlaw these philosophies.

However, the House Irrigation and Reclamation Committee now has before it a bill (HR 5124) designed to outlaw the concepts that power investment shall never be amortized but carried in perpetuity, and that interest thereon shall be used to amortize portions of the irrigation cost chargeable not to water users but to power users.

Lower Rates in Balance

Interior's interest in both propositions is obvious. If it need not amortize this power investment, or, if it can use interest thereon as amortization of irrigation costs chargeable to power, or if it can do both, it can charge for its energy rates substantially below those which otherwise would be required. If such concepts be applied to cost allocations for government power projects all over the United States—and Interior now has marketing jurisdiction over all U. S.-generated power except that of the TVA—Interior would be able to compete with private power not only from the tax angle and the cost-of-money angle, but from the amortization angle as well. While these concepts have thus far been advanced only on reclamation projects—and reclamation is confined to the 17 western-most states—these would, if successful there, be applied wherever Interior markets power.

As is customary, HR 5124 was sent to the relevant department for a report. Interior recommended enactment—with amendments. The amendments show that Interior has:

1. Given up hope of putting over its concept that power costs shall never be repaid.

2. Supported the concept that interest payments on power costs shall be charged against irrigation costs which must be borne by power, not water, users.

That this is true is shown by the language of an amendment proposed by Interior and of its report of the bill. The department suggests "amortization . . . of the construction investment properly allocable to commercial power, . . ." and in explanation thereof, states that the amendment is also designed "to make it clear that rates for power may be fixed in the light of the application of the interest earned on the power investment toward the amortization of the irrigation costs which are payable from power revenues because they are beyond the ability of the water users to repay." This explanation, signed by Harold Ickes, should be convincing. If it is not, consider the testimony of Michael Straus, Reclamation Commissioner, who told the committee that "we feel that we can join in support of the principles of the . . . bill; assuming that it is intended that the interest earned on the power investment may be used as a part of the contribution required from power to hold down the irrigation costs that irrigators can't pay."

A Reduction of 17 Percent

What does all this mean? It means that if it were applied to rates charged for Grand Coulee power—and it won't be—the cost which power revenues would have to repay over 50 years would be $348,000,000 or 17 percent less than the $419,000,000 Grand Coulee power must repay. It means that Reclamation would like to apply the new formulas to all the projects it has coming up.

If, on the other hand, the concept whereunder the power costs never are amortized were to apply, power revenue would have to pay only $234,000,000 on the Grand Coulee project. (Grand Coulee is used solely as an example. Its cost allocation, based on payment of power costs and interest thereon, has been approved.)

NEWS OF THE WEEK

Myers Defends Activities in Utility Company Sales

Claims No Interest in Public-Private Power Fight but Favors New Authorities Buying Instead of Building Facilities—Promoter Makes Known Fees for Handling Sales of Utility Properties—Tax Avoidance Upheld

Guy C. Myers described his function in the sale of electric utility properties into public ownership as "sound, constructive, economical and right," and added that he does not conceive public ownership but merely delivers such transactions.

"I will not argue over public or private ownership," Myers testified before a House Interstate and Foreign Commerce subcommittee investigating the administration of the Holding Company Act. "I merely say that if a property is to go to public ownership, let it go this way."

The statement followed repeated assertions by Myers that when the public decides to go into the power business in a given area, it should buy out existing private companies for a fair price and should not go into competition by building duplicating facilities. Myers said he provided knowledge and capital which made it possible for public bodies to take over private power holdings with a minimum of dislocation after they had decided to do so, and asserted that the fees he received for doing his activities are modest and merited.

Following Myers to the stand was Theodore H. Maenner, Omaha real estate man, who became chairman of the board of Nebraska Power Co. when the property was bought by the Omaha Electric Committee, Inc., in December, 1944. Maenner declared that the sale was a transaction which a majority of the residents of Omaha would endorse even though they never had a direct chance to vote upon it. Asked whether the O.E.C. considered the possibility of savings through elimination of federal income taxes, Maenner declared that such savings were very definitely considered. He added, however, that the tax avoidance was only one of three possible savings which were considered to be available in purchase of the company. Also available, he said, is a $1,000,000 annual saving in dividends on common stock and a $1,000,000 annual saving through refinancing of high-rate preferred stocks and bonds.

"You can't escape the tax saving," Maenner told the subcommittee. "It's there. It's legal. Why should we overlook it?"

Myers said his fees were figured on a scale which calls for 2.5 percent of the first $4,000,000; 1.5 percent on the next $10,000,000; and 1 percent on all costs above $14,000,000. He said his fee for the Nebraska Power sale was $530,000. His total of fees for sales of 16 Nebraska private power properties, he said, was $1,328,000. Total fees for sales negotiated in Washington, he said, were $129,000. Projected sale of the Puget Sound Power & Light Co. would bring him a fee of about $1,000,000, he conceded, and he added that it would be collected only if the transaction were consummated. Previously, he said, a total of $1,900,000 was spent on a similar attempt from which nothing resulted.

Myers denied flatly that sales he arranged depend upon capitalization of the federal tax avoidance or that the price paid for Nebraska Power was out of line. He said he never participated in a transaction which was made possible only by the tax avoidance. He conceded that most such sales would be less attractive if the tax avoidance were removed but insisted that those in which he has had any part would still be possible without it. He conceded that the exemption from taxation of municipal revenue bonds customarily issued to finance such sales is an important factor.

He said that, on a times-earnings basis, private companies have paid higher prices for properties than O.E.C. paid for Nebraska Power and added that they have paid such higher prices since the Nebraska transaction took place slightly more than a year ago. If Nebraska Power were to be bought today by a private company, he went on, the price would be above that the property commanded in December, 1944, because values have gone up.

Agrees with Boren Figures

In response to questioning by Rep. Lyle Boren, Oklahoma Democrat and author of the investigation, Myers conceded the accuracy of the figures which Boren cited when he rose in the House last summer to denounce the Nebraska sale as "Swindle, Inc." He refused, however, to concede that Boren was on the right track in alleging that such sales are possible only through capitalization of the tax avoidance. When Boren asked whether SEC would have allowed a sale at a price so in excess of original cost had the purchaser been subject to SEC jurisdiction, Myers replied that original cost is a ratemaking figure and that it has no bearing on the valuation of a property for purchase purposes.

Maenner said Myers was brought into the Nebraska Power negotiations after repeated attempts to close the sale had met with inexplicable rebuffs. Myers, he said, "appeared to have the key." He added that Myers brought into the transaction and directed the accumulation of capital which was necessary but hitherto

non-existent. He said the fees which Myers and banking syndicate received were fair and the price was good.

In explaining the pre-Myers negotiations on the sale of Nebraska Power, Maenner said Howard L. Aller, president of American Power and Light Co., from which O.E.C. bought Nebraska's common stock, had told him that he (Aller) was under orders by SEC to sell the property. Aller also told him, Maenner testified, that he (Aller) had given the company orders to do all it could to obstruct a sale. If the sale had to be approved by the voters, Maenner said Aller told him, the sale would never take place.

Maenner said the company had not reduced rates in its year under new ownership, but that it had piled up a surplus of more than $2,000,000 instead. He said he would not recommend any move to cut rates until it became apparent that all opposition to the transaction had been eliminated which might entail large legal fees to settle.

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Housing Program Will Not Hinder Utility Construction

Despite the determination of the Civilian Production Administration that the government's program for housing be successful, there is no indication as yet that the broad and rigorous controls over construction and materials which were instituted during war will be reenacted.

The program, drawn up by Housing Expediter Wilson Wyatt, envisages activity in stimulation of housing construction similar to that which the nation witnessed in stimulation of the shipbuilding, aviation, light metals, and similar industries five and six years ago. Included would be subsidies, tax-amortization benefits, vast worker training programs, and all the rest.

Whatever happens, CPA is fully conscious that all housing is of little value without utilities. It is aware also that in some cases existing facilities for the supply of such services will be insufficient without capital reinforcement. Thus any activity it takes toward curtailing non-residential construction to speed housing will be taken with such considerations firmly in mind.

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Will Install 7,500-Kw. Unit

As a part of its $500,000 program of expansion in the Prince Albert district of Saskatchewan, Canadian Utilities will install a new 7,500-kw. steam unit at its Prince Albert plant. Work is underway on a new steam boiler with a capacity of 100,000 pounds an hour.

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Washington Award Will Go to Dr. V. Bush

Presentation Ceremonies Will Be Conducted Feb. 20, in Chicago by Western Society of Engineers

The Washington Award in recognition of devoted, unselfish and preeminent service in the advancement of human progress will be conferred upon Dr. Vannevar Bush, administrator, electrical engineer,

president of Carnegie Institution of Washington, by the Western Society of Engineers on February 20, at Chicago, for his research activities which have contributed to the well-being of humanity by producing devices and instrumentalities of war which have hastened the termination of hostilities.

As dean of engineering and vice-president of Massachusetts Institute of Technology, Dr. Bush rendered outstanding service; and when he became president of the Carnegie Institution in 1939, he brought to his new task the skill of a trained investigator and the experience and resources of a competent executive.

While still retaining his position with the Carnegie Institution, in 1940 he was appointed by President Roosevelt as chairman of the National Defense Research Committee, a governmental agency established for the purpose of supplementing the work of the Army and the Navy in developing devices and instrumentalities of war.

A year later, Dr. Bush was made director of the newly established office of Scientific Research and Development, charged with the duty of mobilizing the scientific effort of the country and advising the President as to the status of scientific research and development in their relation to defense.

Dr. Bush's contributions to engineering science and to society have been previously recognized, and numerous honorary degrees from various universities and many honors and awards have been conferred upon him.

The Washington Award is conferred each year by the Western Society of Engineers on the recommendation of a commission of award representing the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and the Western Society of Engineers.

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Farmers May Get REA Aid to Build Power Plants

Congress had two new power bills laid before it last week, one of which would allow the Rural Electrification Administration to make loans to individual farmers for the purchase of electric plants where farms are too far from existing distribution systems to make service feasible.

The other would allow the adoption of an agreement between the Interior Department and Oklahoma's Grand River Dam Authority regarding the incipient turnback by the former of the latter's Pensacola Dam on the Grand River in Northeastern Oklahoma. The bill would allow, also, refinancing of the Authority's 4 percent bonds and an additional issue of $1,300,000 of 2.5 percent bonds. It was explained that the property, taken over just before Pearl Harbor and later transferred to the Southwestern Power Administration, would have to be turned back under the Federal Power Act unless a special agreement is authorized. Circumstances surrounding the transaction are so complex as to warrant the special agreement, Interior officials declared. The bill was introduced by Sen. Elmer Thomas, Oklahoma Democrat.

The REA bill was introduced by Sen. William Langer, North Dakota Republican. It provides for loans for the "purchase or construction of individual wind or engine-driven generating plants . . ." Congress has been asked by the Wincharger Corp., of Sioux City, Iowa, to consider the use of its product—a wind-driven generator—in expanding rural electrification.

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Milford, Del., to Close Plant

Milford, Del., will close its municipal plant, keeping it in standby condition, and buy its power wholesale from Delaware Power & Light Co. The utility will build a transmission line to the switchboard of the municipal plant. The great demands on the municipal plant have made it impossible to maintain it in an efficient condition.

Utility Buyers Get Picture of Equipment Production

Manufacturers' Representatives Tell Subdivision of National Association of Purchasing Agents, Meeting in Chicago, Likely Delivery Dates for Equipment Used by Operating Companies—Supplies Are Low

A clear, if not altogether encouraging, picture of the production situation prevailing in pole line materials, electrical apparatus, and coal was given last week to utility purchasing agents by speakers at the fifteenth annual midwinter conference of the Public Utility Buyer's Group of the National Association of Purchasing Agents, meeting in Chicago.

Present demand for pole line materials, according to a report by Tom Shaffer, Joslyn Manufacturing & Supply Co., is double that for the peak year of 1941 when the industry produced at capacity rates. This fact, he felt, gave little hope that present demand can be met.

Pole Line Materials Situation

The situation prevailing in various classes of pole line materials as reported by Shaffer follows:

Poles—Present order backlog is such that any new orders will be shipped in 1947. Production in 1946 by the western red cedar pole industry will equal 1941 but WRC production will be supplemented by lodge-pole pine, western larch, and fir. In the southern yellow pine industry, production of white poles will equal 1941 but the shortage of creosote because of the steel strike may force acceptance of substitute treatments.

Crossarms—Prevailing backlog of orders for fir crossarms on the West Coast will take the entire 1946 production. January 1 backlog of orders represented a full year's production.

Pole Line Hardware—A four-month order backlog prevailed January 1. The steel strike is expected to erase two month's additional production from 1946 with the result that any orders received after January 1, this year, will not be shipped until the last half of 1946.

Insulators—Porcelain insulator industry faced a 48 to 52-week order backlog on January 1. Deliveries are being scheduled in 1947 on new orders.

The bird's eye view of the production situation on specific lines of electrical apparatus of one company, presented to the utility buyers by J. H. Jewell, Westinghouse Electric Corp., while disappointing in some respects was not without cheer. Mr. Jewell's remarks, in summary, reflect these conditions:

Transformers—Demand for small rural types during the past six months was "almost insatiable." Westinghouse was reported as rationing production of sizes 5 kva. and under probably until the third quarter of this year. Rationing is not necessary on larger distribution sizes and present long deliveries being quoted may improve. Manufacture of power transformers is limited by a shortage of engineers as well as various materials. Long shipments may prevail for 12 to 18 months.

Meters—The watthour meter situation, as reported by Jewell, parallels that of distribution transformers. Continuation of a program of rationing meter production seems necessary for some months to come, he said.

Advice to those planning or building power plants or substations during 1946 given by Mr. Jewell was to change the sequence of ordering certain equipment due to unusual delivery situations. For example, power transformers may take longer than rotating equipment. Switching equipment should be ordered much sooner than normally because deliveries for major extension will probably run around 30 to 50 weeks for some time to come. Deliveries on outdoor substation equipment may be as long as from six to ten months.

Lightning Arresters Plentiful

On the cheerful side of the ledger Mr. Jewell pointed out that lightning arresters can be obtained on very good deliveries. Capacitors, and some types of low-voltage distribution switching equipment are available on deliveries which are a little longer than normal. On large rotating equipment, deliveries are longer than normal, because of both engineering and material bottle-necks.

Average coal stocks nationally at this time are somewhere between 20 and 25 days with a good many steel plants having considerably less, according to a report by Marshall Pease, Jr., Detroit Edison Co., who foresaw the lifting of Government controls on coal entirely by spring. Pease found it difficult to foresee mine union plans in 1946. He pointed out, however, that coal prices are very high, in comparison with competing fuels, and miners already have received two advances totalling at least 30 percent. He felt that strike possibilities next April hinge entirely on whether Mr. Lewis will be reasonable or unreasonable in his demands. With some reservations, Mr. Pease predicted that, if general conditions return to normal, the industry may expect to pay existing prices for coal requirements throughout the year and that there may be some reduction in the price of coals of secondary quality.

Improvements and developments in electrical equipment in prospect during the coming months were discussed by R. C. Sogge, General Electric Co. Among developments mentioned were a full family of indicating thermal demand meters for use on small power and commercial installations and extension of improved sealing methods to larger transformer ratings in higher voltage classes.

Discussing post-war utility automotive equipment, J. R. North, Commonwealth & Southern Corp. indicated that present day equipment can be considerably lighter and less costly than the larger and heavier units formerly thought necessary. These changes will bring appreciable economic savings, both in initial equipment cost and in operating and maintenance charges, as well as lower depreciation.

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Hampton, Ark., Vote Ends Ouachita Co-op Franchise

By a vote of 173 to 17, residents of Hampton, Ark., have voted to revoke the franchise of the Ouachita Rural Electric Cooperative in Hampton, and to operate a municipal electric system. Under terms of a lease agreement made four years ago, the city reserved the right to revoke the co-op franchise provided the citizens were dissatisfied with the service.

The Hampton distribution system also serves the nearby communities of Banks and Harrell, and it is expected that the city of Hampton will operate these along with the Hampton system when arrangements are made for power supply. The Hampton power plant burned several years ago, and it is reported that a new plant is contemplated.

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San Diego Utility Ups Pay

A 15 percent wage increase, retroactive to the middle of August, 1945, has been awarded to the employees of the San Diego Gas & Electric Co. The increase, announced recently, will affect both union and office workers. According to the utility's officials, the increase will amount to approximately $450,000 annually.

Thompson Asks Relief from Dual Regulation

Recommends Specific Amendments to Holding Company Act in Testifying before House Subcommittee

Earle S. Thompson, president of the American Water Works & Electric Co., last week laid before the House Interstate and Foreign Commerce subcommittee a new facet of the industry's opposition to the Holding Company Act when he asserted that relief is needed from dual and multiple regulation.

"The federal regulation is so broad in scope," Thompson told the subcommittee, "that in actual practice the same transactions now are subject, in most cases, to dual regulation by the states and the federal government and, in some cases at least, they are even subject to regulation by more than one federal agency."

He pointed out that mere recital of appearances before four or five commissions to obtain authorization for a single transaction does not give a true picture of the burden thus presented, "for the various commissions function under different laws and have different forms, requirements and procedures."

First of the specific amendments Thompson proposed would modify Section 21 of the Holding Company Act to give the Securities and Exchange Commission exclusive jurisdiction over transactions subject to the act. Such an amendment would free companies which must clear with SEC from having also to clear with FPC and ICC.

State Regulation Sufficient

Second amendment proposed by Thompson was a modification of Section 2 (a) (7) of the Holding Company Act providing that SEC declare, on application, that a company is not a holding company if SEC finds that applicant's utility assets and all its subsidiaries constitute an integrated utility system or part of a system and that operating revenues of the applicant from its public utility operations constitute at least 50 percent of all operating revenues of applicant and its subsidiaries. Thompson pointed out that some companies which are really operating companies are still classed as holding companies because state laws require that portions of their business be done by subsidiary companies. Such companies, he said, are subject to sweeping state regulation and "their treatment as holding companies under the act serves no useful purpose and merely increases the burdens of dual regulation."

Thompson's third amendment was a suggestion that Section 2 of the Holding Company Act be modified "so as to relieve electric and gas utility companies from federal regulation with respect to various transactions when such transactions are subject to regulation by a state. The Federal Power Act and the Federal Natural Gas Act would be similarly amended."

Thompson's fourth amendment suggested that Section 2 of the act be so modified as to exempt from certain SEC requirements subsidiaries of holding companies when such subsidiaries are not themselves holding companies, public utilities or mutual service companies. Under the act, he said, water works, which are almost always local and intrastate businesses and so regulated, often become subject to overlapping SEC regulation simply because they are subsidiaries of holding companies.

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Secretary of Interior Harold Ickes Resigns

President Truman accepted this week the resignation of Harold L. Ickes who had served as Secretary of the Interior since March 4, 1933.

The last member, with the exception of Henry Wallace, of any cabinet of the late President Roosevelt, Ickes was the spearhead of the broad and highly effective public power campaign instituted 13 years ago by the New Deal.

No successor to Ickes was announced immediately. However, the name of D. Worth Clark, former Senator from Idaho, continued to be mentioned by observers close to the Interior Department.

Ickes' resignation was received by the White House, Tuesday. Wednesday Mr. Truman sent a letter of acceptance. The resignation became effective on Friday. Oscar L. Chapman, an assistant secretary, became acting secretary.

Ickes' resignation had been expected since the death last April 12, of the man who elevated him to cabinet rank. As other New Deal stalwarts drifted into discard, Ickes remained in office; and rumors of his imminent departure therefrom continued as commonplaces in Washington.

Last week the resignation pot boiled furiously again after Mr. Truman issued a statement on his nomination of Edwin Pauley for Under Secretary of the Navy. The President declared that Ickes might be mistaken in his assertion that Pauley had urged the dropping of a government suit to quiet title to tideland oil deposits in California. The nature of the President's statement was such as to constitute a distinct rebuke to Mr. Ickes, most Washington observers agreed.

Duquesne Light Union Off Job for 19 Hours

Supervisory Employees and Interconnections Hold 170,000-Kw. Load —Mediation Board Ready to Meet

Members of the independent union employed by Duquesne Light Co. returned to work about midnight Tuesday after a 19-hour walkout which gave Pittsburgh the dubious distinction of being the first major city in the country to suffer from an electric utility strike.

When the union men walked out after the company had responded to their demand of a 20 percent increase in wages with an offer of 7½ percent, Duquesne officials acted promptly to retain as much of the load as possible.

Supervisory employees were rushed to the Colfax and James H. Reed plants, two of the four major plants of the company, and succeeded in keeping capacity to 90,000 kw. Interconnections with West Penn Power Co., Pennsylvania Power Co., and the Ohio Power Co. added another 80,000 kw., making a total of 170,000 kw. Duquesne has a rated capacity of 642,700 kw. for its system.

Residences Get Lighting

With much of the industrial load unneeded because of strikes and with power denied to other industrial and commercial users, there was little difficulty in holding the residential load. Occasionally, an area would be dumped for a short time. Trolley lines were closed down, virtually paralyzing transportation in Pittsburgh and nearby communities. Thirty coal mines were also forced to close.

The union has 1,800 members among Duquesne employees and has several other branches among other companies in the Pittsburgh area. A company spokesman couldn't say exactly how many men were out, and in response to a question as to the number of supervisory employees who were put to work, said, "We didn't stop to count them. We just sent them to their posts."

Mediation Board to Meet

A three-man mediation board will begin hearings Monday to settle various points of the dispute. The board will consist of Mayor David L. Lawrence of Pittsburgh, Charles F. Kutz, a conciliator of the Department of Labor, and William H. Chestnut, State Secretary of Labor and Industry.

One effect of the strike was the cancellation by the West Penn Power Co. of the formal dedication of its new No. 7 unit at its Springdale plant, scheduled for February 13.

REA Seeks Another $100,000,000 for Loans

Truman and Budget Director Smith Favor Extra Funds to Make Possible Added Construction by Co-op

Congress has been asked to authorize additional borrowing power up to $100,000,000 for the Rural Electrification Administration to enable REA to meet "an unprecedented demand for electric service from farm people (which) has flooded established rural electrification borrowers with applications for service."

The request, endorsed by President Truman and Budget Director Harold D. Smith, would increase to $300,000,000 the new loan funds available to REA in the fiscal year ending next June 30. In addition to the new loan funds, it had available another $100,000,000 in allocated but unadvanced funds which could not be spent during the war.

The supplementary request was sent to Congress after weeks of inaction on the Poage bill whereunder REA sought $550,000,000 in loan fund authorizations for a three-year post-war line building program. The bill has been stalled in a subcommittee of the House Interstate and Foreign Commerce Committee since early fall, although it was expected that the subcommittee which held hearings on it would report favorably to the full committee this week.

Budget Director Smith asserted in his justification that:

"In addition, farmers in wholly unserved areas are organizing new electric cooperatives in large numbers.

"To meet the greatly accelerated demands, $142,000,000 had been allocated to 659 borrowers in 44 states and Alaska as of December 31, 1945, leaving only $58,000,000 (of the $200,000,000 in new loan authorizations for fiscal 1946) for allocation during the balance of this fiscal year to cover applications on hand or in process of preparation amounting to more than $200,000,000.

"Unless additional loan funds are authorized for this fiscal year. . .

"1. Construction now in progress will be slowed down and in many instances actually halted before June 30, 1946.

"2. New cooperatives cannot proceed with detailed construction plans because allocations must first be made.

"3. The organization and establishment of new cooperatives are made difficult because allocations must be made in many states before certificates of convenience and necessity are issued, all of which must precede detailed construction planning.

"4. No further allocations can be made in 21 states inasmuch as their apportionments of present loan authorizations have been exhausted or already committed for allocation.

"5. No allocations can be made in connection with many applications now on hand from the 297 cooperatives which have received no allocations this fiscal year.

"6. The rural electrification program cannot go forward in the most orderly and efficient manner, and an unnecessary delay in the extension of the benefits of electric service to rural areas would result."

Whether the present wave of strikes will act to delay the appropriation is uncertain.

Clamp and Connector Difficulties Discussed

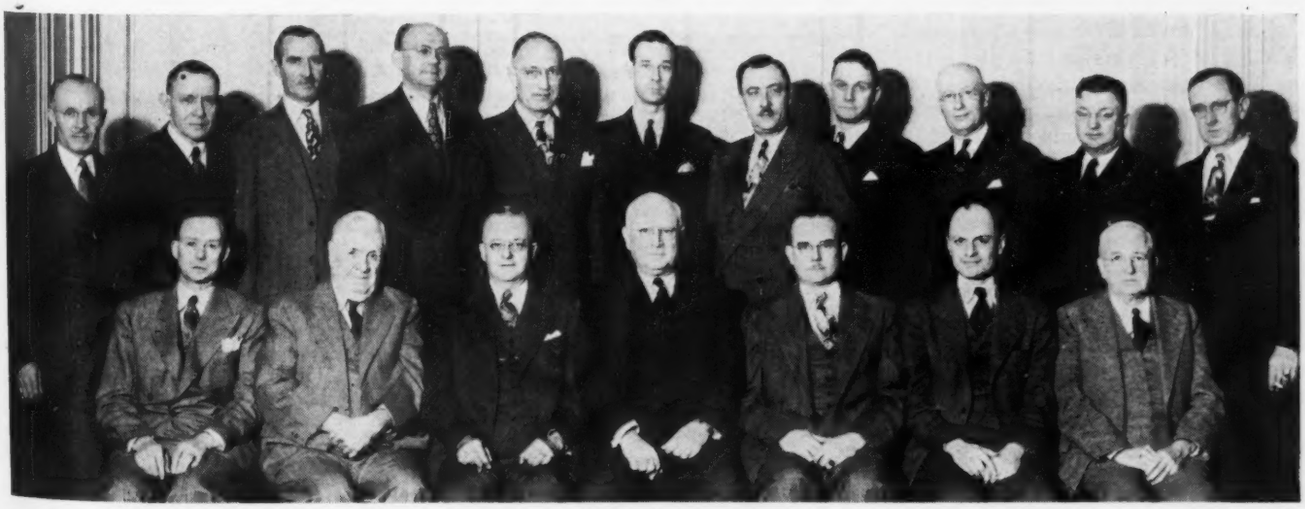
P.E.A. Committee Told Capacity of Transmission Line is Limited by Carrying Capacity at Joints

Difficulties with clamps and connectors received spirited discussion at the Philadelphia meeting of the Pennsylvania Electric Association's transmission and distribution committee on February 7-8.

It was asserted that several anomalous experiences need better explanations than those so far offered. For example, there was the statement that with two clamps, one is more likely to burn off than if there is only one; another experience was the burning of a 3-bolt clamp in the middle of a wire reinforcement held at the ends by split-bolt clamps.

L. M. Olmsted, Duquesne Light Co., said very flatly that transmission line capacity is limited by the permanence of carrying capacity at the joints. There seemed to be most confidence in compression type splices.

One utility surveyed a 3.4-sq. mi. area with a prospective load of 8,000 kva. per sq. mi. to ascertain the most economical pattern of distribution supply. An unsectionalized primary network with 2,000-kva. units showed a relative cost of 73 percent (sectionalized, 84); with 1,500-kva, units, 84 and 99 percent, respectively; a multi-unit substation, 87 percent; and single substations as follows: large (27,000 kva.), 100 percent; medium, 106 percent, and small (22,000 kva.), 103 percent. Other member companies will continue this series of distribution analysis reports which will be



OFFICERS AND DIRECTORS OF ELECTRICAL LEAGUE OF CLEVELAND—Jack North, Cleveland Electric Illuminating Co., pictured with other officers and directors following his election as League president for his 24th successive term. Left to right, front row, A. C. Berg, H. Hutchinson, treasurer; L. T. Blaisdell, vice-president; Mr. North; W. L. Howlett, vice-president; S. E. Strunk, secretary; H. L. Martien. Rear row, G. E. Fruehauf, J. J. Bohning, F. R. Maguire, J. A. Foukal, A. F. Head, W. T. Clark, H. G. Frank, W. E. Henges, F. G. Hickling, F. J. Hopperton, C. B. Gray.

discussed at later association meetings.

Reconversion among utilities is primarily a matter of rebuilding manpower and reinstating the capacity margins that make operation comfortable, said R. G. Rincliffe, vice-president of Philadelphia Electric Co., at a luncheon talk. The more than 8 percent of men over 65 necessitates an immediate training program for replacements and for force expansion. The engineers, he said, can help with the screening of selectees for the training programs. L. R. Gaty, of the same company, mentioned the importance of plans for emergency restoration, partly because of the rising pressure to render lines stormproof.

Support for the significantly successful program of J. W. Anderson's group in negotiating limiting values of compressor-motor starting currents was besought by Gaty. Anderson pointed out that an unsolved aspect was the uncertainty as to service for single-phase and polyphase motors and which of the two the manufacturer would supply; he added that the pre-war national committee on motor-starting currents is again active.

Progress in simplification of line hardware was reported by H. R. Wilbur, but he was fearful that the revived agitation for the extended-back secondary rack would raise to double the ten or eleven models now achievable. R. G. Wheaton, of Line Material, said his company still has to carry over 250 patterns.

A considerably lower percentage of faulty operations (3 out of 1,630 operations of 125 units) was reported for oil-filled reclosing devices than for those other than oil-filled (28 out of 330 operations of 632 devices).

Series Lighting Favored

A company with 108,000 street lights, 90 percent of which are series, is seriously thinking of changing to multiple in residential areas. A manufacturer was announced as contemplating an inexpensive individual photocell control to avoid the need for pilot circuits. A show of hands reflected preference for retention of series lighting in most situations.

Comprehensive report on kilovar supply was promised by M. M. Devorris. Recent survey among nine companies showed capacitor kilovars on distribution ranging from 1½, 2½, 3 and 5 percent to as high as 27 percent of the system's maximum reactive requirements.

Manufacturer's contribution to the sessions comprised a description of the Copperweld fabrication process by F. E. Leib of Copperweld Steel, a discussion of impulse strength design of high voltage transformers by L. C. Aicher, and of preferred ratings of distribution transformers by J. B. Hodtum, both of Allis-Chalmers Manufacturing Co.

Eastern Oregon Light Sale Gets Approval of Directors

Directors of the Eastern Oregon Light & Power Co. recently approved an offer from the California Pacific Utilities Co. to purchase their company's properties for a reported $2,300,000.

To close the sale, approval must now be obtained from the stockholders of Eastern Oregon, and from the Public Utilities Commission of Oregon and the California Railroad Commission. The approval of the stockholders must be secured before the sale can be completed.

Focal point of the deal seems to be La Grande, Ore., where both companies are at present operating electrical facilities. Besides La Grande, California-Pacific will add the towns of Baker, Elgin, Cove, Haines and Union to their distribution system as a result of the transaction. They are already serving in Burns and John Day, as well as having other utility properties in Idaho, Wyoming, Nevada and California.

At the directors' meeting, J. A. Ward, president of California-Pacific, assured LeRoy A. Grettum, retiring president of the Oregon firm, that all employees, including those still in the armed services, would be invited to join the California-Pacific organization at present wages and salaries, with seniority retained, and expressed the hope that all Eastern Oregon Light & Power personnel would remain with the new management if the sale is approved.

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Canadian Output Statistics

The Dominion Bureau of Statistics has released the following output statistics of Canadian central electric stations in thousands of kilowatt hours:

Period	1945	1944
Eleven months	36,811,898	37,109,631
Primary	30,580,452	33,674,798
Secondary	6,231,446	3,434,833
Exports to U. S.	2,413,509	2,371,187
November	3,018,399	3,252,394
Primary	2,545,482	2,904,454
Secondary	472,917	347,940
Exports to U. S.	218,587	187,257
October	3,309,021	3,482,045
Primary	2,762,459	3,107,635
Secondary	546,562	374,410
Exports to U. S.	224,801	219,303

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Municipal Extends System

Frankfort, N. Y., which operates a municipal system, has been authorized by the Public Service Commission to extend its services to parts of the towns of Frankfort and Schuyler, in accordance with franchises granted recently by the two town boards.

MEETINGS

Previously Listed

Edison Electric Institute—Transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 18-19; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 20-21; general sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4. Col. H. S. Bennion managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials — Spring meeting, Pittsburgh, Pa., February 25-March 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

National Rural Electric Cooperative Association—Annual meeting, Buffalo, N. Y., March 4-6. Avery C. Moore, secretary-treasurer, 416 5th St., N. W. Washington 1, D. C.

Oklahoma Utilities Association—Annual convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12, Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City 2, Okla.

North Central Electrical Industries—Convention and trade exposition, Radisson Hotel, Minneapolis, Minn., March 11-13. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Southeastern Electric Exchange—Engineering and Operation Section, Tutwiler Hotel, Birmingham, Ala., March 14-15; annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 24-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

American Society of Mechanical Engineers—Spring meeting, Hotel Patten and Reid House, Chattanooga, Tenn., April 1-3. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 3-5. S. E. Winston, director, Illinois Institute of Technology, Chicago 16, Ill.

National Electrical Manufacturers Association — Spring meeting, Palmer House, Chicago, Ill., week of April 8. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Missouri Valley Electric Association—Engineering conference, Hotel Continental, Kansas City, Mo., April 10-12. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Electrochemical Society — Spring meeting, Tutwiler Hotel, Birmingham, Ala., April 10-13. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

National Electrical Wholesalers Association—Annual convention, Stevens Hotel, Chicago, Ill., April 21-25. C. G. Pyle, managing director, 500 Fifth Ave., New York, N. Y.

Society of the Plastics Industry—National plastics exposition, Grand Central Palace, New York, N. Y., April 22-27. John Wetherby, secretary, 295 Madison Ave., New York 17, N. Y.

American Institute of Electrical Engineers—Northeastern district, Buffalo, N. Y., April 24-25. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

International Lighting Exposition — Stevens Hotel, Chicago, Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Blvd., Chicago 54, Ill.

National Association of Corrosion Engineers—Annual convention, President Hotel, Kansas City, Mo., May 7-9. Elton Sterrett, executive secretary, 318 Southern Standard Bldg., Houston, Texas.

Great Lakes Power Club—Spring meeting, Palmer House, Chicago, Ill., May 24. Almer Skretting, secretary-treasurer, Wisconsin Electric Power Co., Milwaukee 1, Wis.

Pennsylvania Electric Association—Engineering Section, all committees, Penn Harris Hotel, Harrisburg, Pa., May 28-29. E. B. Shew, chairman, Philadelphia Electric Co., Philadelphia 5, Pa.

Minnesota Co-ops Dispute Anti-Poage Bill Testimony

A denial that C. H. Gelder, manager of the Dakota County Electric Cooperative, Farmington, Minn.; Lee M. Nelson, manager of Municipal Utilities, Rochester, Minn.; and other co-op managers from the state who testified against the Poage Bill at hearings last October before a House Interstate Commerce subcommittee, represented any opinion other than their own, has been made by the Minnesota Electric Cooperative.

The Cooperative, a state association of REA Cooperatives, moved by the testimony at the Washington hearings (ELECTRICAL WORLD, October 27, 1945, Page 95) and the publicity which followed, passed the following resolution:

"Be it resolved by the Minnesota Electric Cooperative that it is the consensus of the sentiments of the members of this state association that any publicity, impression or claim that Mr. Nelson or the two or three REA managers appearing at said hearing represented or were in any way authorized to speak for the other projects in the state is definitely unfounded and a misrepresentation of the facts, and that the true attitude of most of the projects in the state is clearly shown by the unanimous resolution adopted by this meeting endorsing the Poage Bill and recommending its passage."

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Kentucky Utilities Names Paducah Sale Appraiser

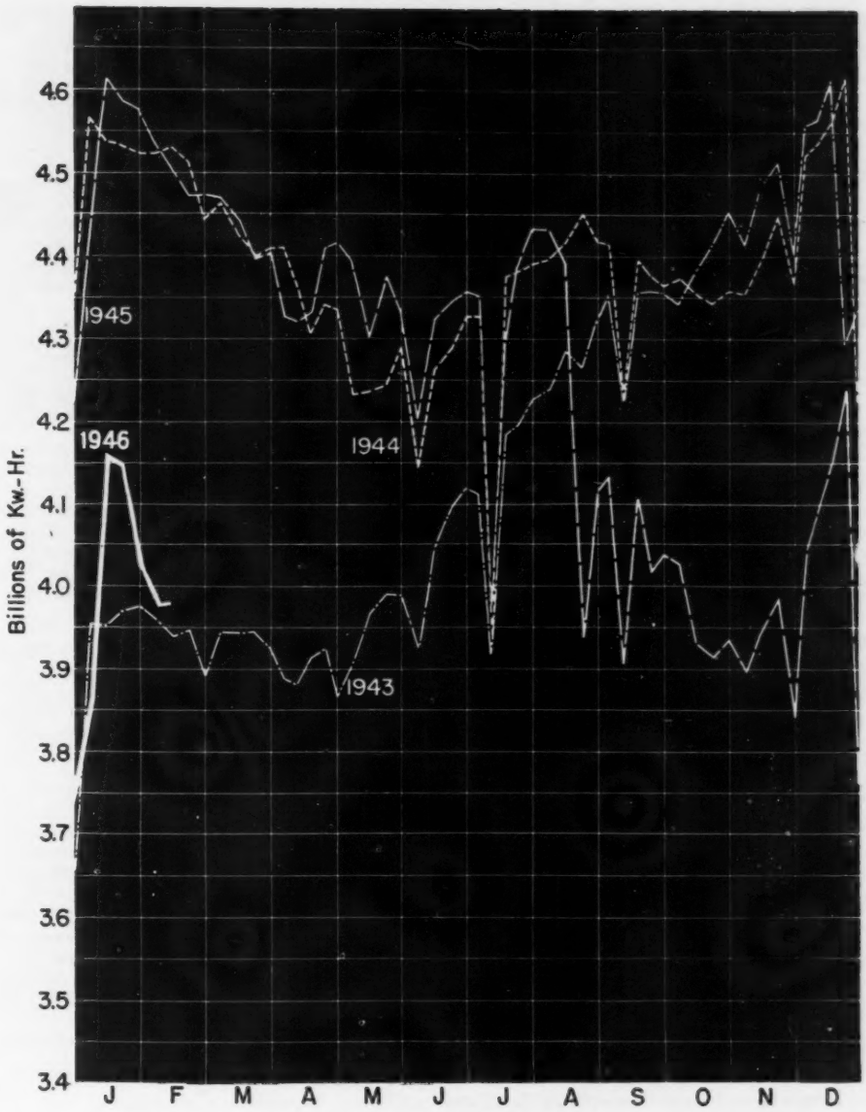
Kentucky Utilities Co. has appointed Jay Samuel Hart, Chicago, as its appraiser to aid in fixing the value of the company's property in Paducah.

The appointment was made after the Court of Appeals upheld a mandatory injunction in McCracken Circuit Court, directing that the appraiser be appointed under terms of a franchise granted by the City of Paducah. The city is proceeding under the franchise to purchase the electric and gas properties of the utility in Paducah.

In announcing appointment of the appraiser, Kentucky Utilities pointed out that the action is solely in compliance with the court order and in no way waives its contention that the order forcing the appointment is erroneous.

The utility claims it is not bound by the 1940 franchise under which the city is seeking to buy the system, contending that the franchise was voided by the 1942 Tennessee Valley Authority Enabling Act.

Paducah has named L. R. Howson, Chicago, as its appraiser.



Output Curve Moves Slightly Upward

The electric output curve moved slightly upward during the week ended February 9, 1946, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 3,983,493,000 kw.-hr., compared with 3,982,775,000 kw.-hr. revised during the preceding week. During the week ended February 10, 1945, the amount of electrical energy distributed amounted to 4,505,269,000 kw.-hr., this year's figure representing a decrease of 11.6 percent.

In all regions of the country but one, output was below that of the corresponding week in 1945. The one exception was again the Rocky Mountain group, which showed an increase of 3.0 percent. The largest decrease was reported by the central industrial states, which showed a drop of 19.4 percent. The Southern states reported a loss of 13.9 percent. In the entire United States the decrease amounted to 11.6 percent.

Revised figures for the week ended February 2 put the decrease for the country at 12.2 percent, as compared with last year.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Feb. 9	3,983	Feb. 10	4,505	Feb. 12	4,533
Feb. 2	3,983	Feb. 3	4,539	Feb. 5	4,524
Jan. 26	4,034	Jan. 27	4,577	Jan. 29	4,524
Jan. 19	4,145	Jan. 20	4,588	Jan. 22	4,532
Jan. 12	4,163	Jan. 13	4,614	Jan. 15	4,539
Jan. 5	3,865	Jan. 6	4,427	Jan. 8	4,568
1945		1944		1943	
Dec. 29	3,759	Dec. 30	4,226	Jan. 1	4,337†
Dec. 22	4,239	Dec. 23	4,617	Dec. 25	4,295
Dec. 15	4,154	Dec. 16	4,563	Dec. 18	4,613
Dec. 8	4,097	Dec. 9	4,538	Dec. 11	4,567
Dec. 1	4,043	Dec. 2	4,524	Dec. 4	4,560
Nov. 24	3,841	Nov. 25	4,369	Nov. 27	4,403

†1944

Percent Change from Previous Year

	Week Ending		
	Feb. 9	Feb. 2	Jan. 26
New England	— 2.1	— 4.8	— 5.0
Mid Atlantic	— 3.8	— 5.0	— 5.3
Central Industrial	— 19.4	— 19.6	— 18.8
West Central	— 3.3	— 2.3	— 3.8
Southern States	— 13.9	— 13.2	— 11.2
Rocky Mountain	+ 3.0	+ 1.7	+ 3.3
Pacific Coast	— 10.0	— 13.2	— 14.4
Total United States	— 11.6	— 12.2	— 11.9

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

CRESCENT PUBLIC SERVICE Co.'s amended plan of liquidation, covering certain of its affiliates and subsidiaries, has been approved. The commission ruled on January 22 that Crescent should be allowed fifteen days in which to file an amendment to its original plan, making changes necessary to effectuate the provisions of Section 11 (b) of the Public Utility Holding Company Act of 1935. Under the amended plan the exchange offer to holders of the 6 percent income bonds of Crescent is modified to provide that thirty shares of the common stock of the Central Ohio Light & Power Co. plus $80 in cash are to be offered for each $1,000 of bonds, instead of thirty shares and $180 in cash as originally proposed. The amended plan further provides that at the time the holders of the income bonds are notified of the availability of the exchange offer, they shall also be notified of the decision of the officers, directors and affiliates of Crescent, as to whether they will respectively accept or reject the exchange offer with respect to their direct and indirect holdings of income bonds. Crescent also reserves the right, at any time prior to the date upon which the exchange offer is made to the holders of income bonds, to amend the plan to the extent necessary to eliminate the provisions of the exchange offer and to take such steps as may be appropriate to redeem the income bonds, pursuant to the provisions of the indenture under which they were issued. The commission also ordered the company to dispose of all of its interest in Colorado Central Power Co. of Denver, and Empire Southern Service Co., Big Spring, Tex. (Release No. 6396).

CONSUMERS POWER Co.'s legal fees and those incurred by the successful bidders for $113,825,000 principal amount of that company's first mortgage bonds recently offered for sale have been freed of SEC jurisdiction. The action released $40,000 in fees and expenses payable by Consumers to its counsel, and $20,000 payable to attorneys for the underwriters. (Release No. 6397).

IOWA POWER & LIGHT Co.'s proposal to amend its articles of incorporation and to refinance its outstanding 38,700 shares of $100 par value 6 percent preferred stock and 11,300 shares of $100 par value 7 percent cumulative preferred stock has been approved. The refinancing is to be accomplished by an offer to holders of old preferred to exchange their shares on a share-for-share basis for new cumulative preferred stock, or by the sale of such number of shares of new preferred as would equal the difference between 50,000 and the aggregate number of shares of old preferred deposited for exchange and the use of the proceeds of the sale of new preferred, plus treasury cash, to redeem on April 1 all the outstanding shares of old preferred not deposited for exchange. Iowa plans to make the exchange offer during the last half of this month, the period to run for approximately nine days. The company proposes to invite competitive bids for services in effecting the exchanges and for the purchase of such of the 50,000 shares of new preferred as are not required for the exchange. The proposed charter amendments deal, among other things, with authorization for the issuance of 100,000 share of $100 par value cumulative preferred stock, of which 50,000 will be issued in connection with the exchange offer. (Release No. 6398).

OHIO POWER Co.'s amended application, proposing that it acquire for $750,000 cash, 7,500 shares of the $100 par value capital stock of Central Ohio Coal Co., a new corporation to be organized under the laws of the State of Ohio, has been approved. Central Ohio Coal Co. would be authorized to issue 25,000 shares of capital stock, and would be a wholly owned subsidiary of Ohio Power formed for the purpose of operating a strip coal mine on land owned by Ohio Power, and of buying and selling coal in the interests of Ohio Power only. (Release No. 6395).

TEXAS PUBLIC UTILITIES CORP. has been authorized to sell its water plant and distribution system to the city of Llano, Tex., for $85,000 cash, subject to minor adjustments with respect to accounts receivable, additions and betterments. (Release No. 6394).

UNITED CORP. has been authorized to solicit proxies from stockholders in support of its plan (1) to reduce its authorized common stock to 18,261,551 shares from 24,000,000; (2) to reduce the $3 preference stock to an authorized 1,214,700 shares from 5,000,000 shares and (3) to give the preference and common stocks par values of $5 and $1 a share, respectively, from no par at present. The capital changes were approved by the SEC and now are subject to approval by a majority of each class of stock. (Release No. 6399).

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$31,000,000 Sales Indicated

Pacific Power & Light Co. found in a recent electric appliance survey that prospects point toward selling about $31,000,000 worth of electrical apparatus within the next five years to homes and farms served by the company. Annual purchases are estimated to be $6.000.000, with the peak year slated for 1947. Half of the families plan on new refrigerators during the five-vear period and one-third will purchase electric ranges.

UTILITY REPORTS

	Net Income 1945	1944
*Arkansas Power & Light....	$1,829,297	$2,079,344
†Electric Bond & Share and subs	2,768,274	4,622,479
†Idaho Power	1,624,261	1,406,143
*Louisiana Power & Light	1,126,245	842,244
*Mississippi Power & Light ..	844,789	1,389,297
*Pennsylvania Power & Light	5,292,232	5,521,879
†Public Service of Colorado .	2,609,403	2,383,238
*Washington Water Power ..	2,357,441	2,253,213

*Twelve months ended November 30.
†Twelve months ended December 31.

Halsey Stuart Censure Revoked by Association

Halsey Stuart & Co., Inc., Chicago, should not have been censured last November (ELECTRICAL WORLD, November 10, 1945, Page 134) by the Business Conduct Committee, District No. 13, of the National Association of Security Dealers, for its conduct in seeking to arrange the sale of bonds of the Connecticut Light & Power Co. competitively.

This decision has just been made by the board of governors of the association to which the Chicago investment banking firm had appealed.

The Connecticut utility desired to sell $16,000,000 of bonds to eight institutions without offering them for competitive bidding because of lack of time. Halsey Stuart offered to buy a temporary issue of the bonds at a higher price pending arrangements for a competitive sale. However, after hearings before the Connecticut Public Utilities Commission, at which Halsey Stuart objected to the non-competitive sale, the commission approved the utility's plan.

C. L. Campbell, president of Connecticut Light, then complained to District No. 13 of Halsey Stuart as being guilty of unethical conduct, and the formal censure followed.

The board of governors in its decision said, "One of the respondent's (Halsey Stuart) purposes in appearing at the hearing and presenting its offer was to induce the Connecticut commission to withhold approval of the private placement which had been negotiated. To the extent that respondent's action was intended to bring about withholding of commission approval, respondent's conduct did not constitute an attempt to induce a breach of a firm contract by one of the parties thereto, in violation of Section 1 of Article III of the rules."

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Consultant Approves Sale of Salt River Utility to U. S.

Representing a shareholders committee of the Salt River Valley Water Users Association, Harry G. Butler, San Francisco consulting engineer, has reported that the proposed sale of the electric properties of the association to the United States would be profitable to both parties.

The sale, which has been under study for over a year, would give the government eight hydro plants, one diesel plant, and a steam plant. The sale price would be about $24,000,000.

Before the sale can go through, it must be approved by the Secretary of the Interior, Congress, and the stockholders of the association.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Distribution Substation Design Standardized*

J. COLEMAN JONES

Superintendent of Transmission
Florida Power & Light Co., Miami, Fla.

For long range planning, standard distribution substation design has been adopted by the Florida Power & Light Co. The design is adequate for loads which might be experienced and at the same time permits easy interchangeability of equipment and uniformity of maintenance.

The steel switching structure has footings 11 ft. by 14 ft. and is 28 ft. high. It serves as the high tension structure to support the necessary bus, sectionalizing switches and transformer switch, with low tension connections from the transformer. Attached to this steel structure is a low tension structure of 1¼-in. pipe supporting buses, switches, service and metering transformers for two reclosing feeders. With the exception of a combination telephone booth and battery house, the substation is entirely outdoor type. These units can be assembled in any number required and used as line switching structures as well as substation structures. The steel structure, built according to company specifications, can be assembled, except for foundations and equipment, in a single day by five men.

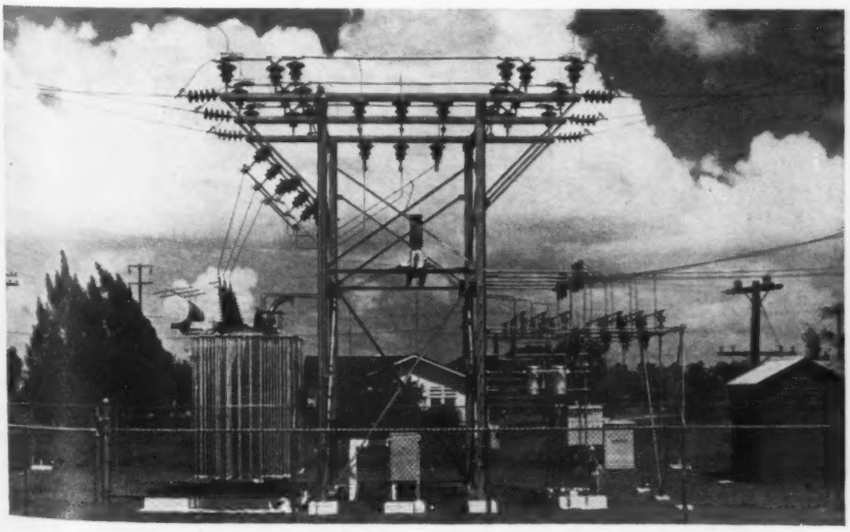
As the load grows in the larger metropolitan areas, 13-kv. distribution is used in the outer fringes of the 4-kv. areas to take load off the ends of these feeders to permit shortening them. The 13-kv. distribution substations are interconnected on the low voltage side to permit transfer of load from one to another, thereby reducing the spare equipment required in them. In this way substations with one three-phase transformer can be used with reasonable protection to service from transformer failures.

Transformers are bought with low voltage windings suitable for operation at either 4-kv. wye or 13-kv. wye. Outdoor oil circuit breakers have at least 250,000-kva. interrupting capacity and are equipped for instantaneous reclosing. Joint construction with communication systems is commonly used on both 4-kv. and 13-kv. systems. Neutral reactors are used on these 13-kv. joint use circuits to limit the ground currents, with instantaneous ground relays for initial tripping and time delay ground relays for subsequent operations before lockout to permit blowing fuses on lateral circuits. Lightning arresters are used only on the low voltage feeders. Unfused gaps are used on the high voltage bus, as the almost complete absence of transformer failures due directly to lightning hardly makes the use of high voltage lightning arresters justified. This record is no doubt partly due to the relatively low insulation level of transmission lines. While the use of these gaps increases the number of relay operations on the transmission lines, the percentage increase is relatively small in an area where lightning flashovers average one per mile of line per year. High speed relays and reclosing oil breakers on the transmission system minimize the effects of these relay operations.

More Substations

Present tendency is toward increasing the number of substations in an area rather than increasing the capacity of individual substations. This reduces the hazard to service from major substation failures, reduces interrupting duty of oil circuit breakers and, by keeping feeder lengths at a mini-

* Adapted from a paper before an E.E.I. Electrical Equipment Committee meeting.



DISTRIBUTION SUBSTATION is typical of standardized design and installation

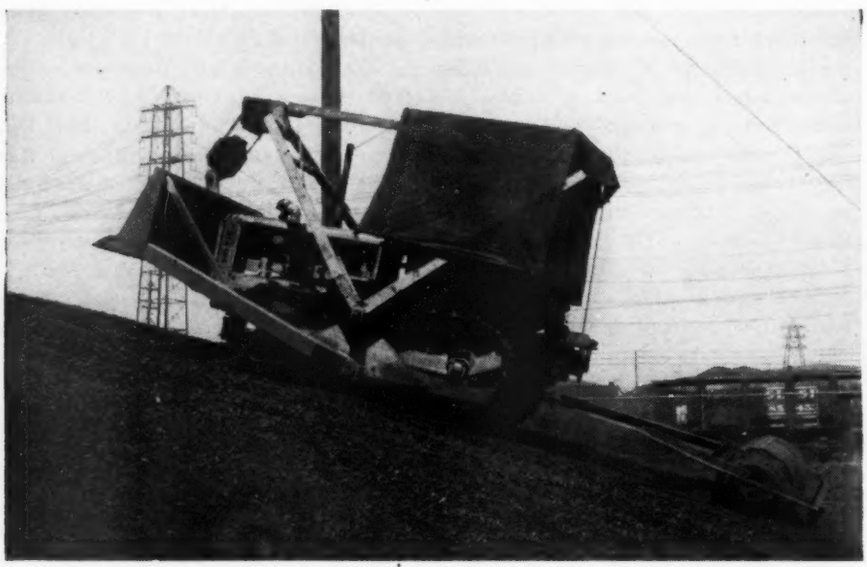
mum, practically eliminates use of regulators on 13-kv. distribution systems. While the substation just described can be built up to any desired capacity by increasing the number of units employed, it is doubtful if distribution substations will be built with more than 10,000-kva. capacity and four feeders.

•

Roll Coal Pile To Cut Fire Losses

The trick of keeping fire losses to one-half of 1 percent in storing bituminous coal is a matter of three simple rules, according to J. A. Keeth, manager of power production, Kansas City Power & Light Co. They are: (1) Roll the pile thoroughly to compact the coal and keep out air; (2) test the temperature of the pile periodically with a thermocouple and (3) haul hot coal quickly to the boilers.

There was a time when it was believed that only nut and semi-anthracite coal could be stored successfully. However, by compacting the pile when the coal is put down to eliminate air, any kind of coal can be stored with a minimum danger from fire losses, even coal with comparatively high sulphur content.



POWER SPREADER puts down new coal in layers 8 to 12 in. thick, preparatory to rolling with tractor. Temperature readings are taken frequently in the pile

COMPACTING COAL with a crawler tractor and 3½-ton roller at plants of Kansas City Power & Light Co. increases density from 40 to 45 lb. per cu. ft. to 55 or 60 lb. per cu. ft. Resulting elimination of air cuts coal fires

The procedure at Kansas City is to put coal on the storage piles in layers from 8 in. to 1 ft. thick using a blade scraper, compacting each layer individually. Compacting is done with a small crawler tractor and a 3½-ton roller which pass back and forth over the freshly dumped coal. Starting with coal weighing 40 to 45 lb. per cu. ft., rolling boosts the density to 55 or 60 lb. per cu. ft. The important thing, however, is that it squeezes the air from the pile, eliminating the chance for spontaneous combustion except at the edges of the pile where some air gets in. Kansas City Power & Light Co. stores its coal in 25-ft. piles and it becomes so tightly packed that it has to be loosened with a bulldozer.

Storage Pile Temperatures

Temperature readings are taken in the pile at frequent intervals. This is done with a thermocouple enclosed in a pipe driven into the pile. In addition, storage piles are constantly watched for signs of steam. This is a sign that the coal is hot and there's danger of fire. Where steam is found, immediate exploratory temperature readings are taken in the area and the hottest coal is headed for the furnaces without delay. Frequently "hot spots" on the edges of the piles can be prevented from firing by smothering with a small quantity of earth well compacted. Where storage space permits, the side slopes of the piles should be flat enough so that the tractor and roller can be used on the slopes, thus compacting the sides as effectively as the main ledge of the pile.

This procedure of rolling, frequent temperature checks and burning of hot coal as soon as detected has been completely successful as evidenced by the fact that this company has never experienced a serious loss from fire in its coal storage piles.

•

Transformer Loading Checked Year Round

A systematic verification of the loading on single- and three-phase transformer installations is continuously in progress on the distribution system of the Wisconsin Electric Power Co., Milwaukee, winter and summer. Load is checked on all single-phase transform-

ers over 5 kva. in size in cycles of three to four years. Loading of three-phase installations over 10 kva. is verified every two to three years. In the case of rural and other transformers smaller than 7½ kva., however, loading is estimated from experience and knowledge of customer habits.

Wisconsin Electric Power Company

MAX-I-METER READING

LOCATION 2nd p. #30-1062, South of W. Walker St, Alley West of So 75th St

BOOK 10 MAP 2480B BY CW

Read and remove two Max-I-Meters on

15 KVA. 1 phase transformer

METER	CONDUCTOR	RATIO	PRESENT READING	MAXIMUM READING
21	W	20/1	2.2	3.3
22	E	20/1	1.4	3.2

AMPS.	KVA.	TOTAL KVA.
66	7.9	15.6
64	7.7	

Remarks or Spot Readings:

27 Services
8 Ranges

STARTED 10 00 A COMPLETED 10 30 A

DATE 5-26 19 45 BY

TRANSFORMER LOAD DATA secured in periodic checks of single- and three-phase installations is recorded on these forms (3¾ in. by 8½ in.) which also comprise permanent record of loading

Checking is done with Max-I-Meter-type ampere demand meters which are installed for a period of 24 hours at each location to determine the daily maximum 15-minute peak.

The practice is to check load on single-phase installations in winter, three-phase in the summer. The heaviest single-phase loads occur in winter when days are short and lighting load contributes to an evening peak. Three-phase load, being more stable and less subject to seasonal variation, can be checked in summer. Thus the test crew of two men and a small truck can be kept busy the year round.

This crew, on the average, sets 30 instruments per day (15 installations) in summer and about 40 instruments per day (20 installations) in winter. Usually an extra crew is assigned to assist in this work during winter months.

Form used to record the load data also constitutes the permanent record of the transformer load at a particular installation. Slips shown are filed by map number.

• • •

Overhead Rack Ventilates Cables

In developing an eastern utility's steam plant to meet expanding loads it was found necessary to replace a 2,300-volt underground cable run between generators and outdoor transformers with overhead ties, in order to secure improved ventilation of conductors. To support these cables a steel bridge was erected (Fig. 1), giving about 26 ft. clearance above ground and a run of about 70 ft. from the station building to the turn-off point near a 10,000-kva., three-phase transformer, and a bridge of similar general design (Fig. 2) to carry another group of cables tying into two other 10,000-kva. transformers sharing the same outdoor substation area. Six 2,000,000-cir.mil cables with varnished cambric insulation were provided for each transformer tie from the plant interior.

In general, the cables are mounted 12 in. apart on centers horizontally and 15 in. apart on center lines vertically, support being by porcelain insulators located on angle-irons fastened into a frame of structural steel in which the members ranged from 15-in. to 8-in. I-beams and a 10-in. channel to 3-in. channels and small angle type cross bracing designed to meet the local spans and weight dispositions. The runway (Fig. 2) was made approximately 8 ft. high by 4 ft. wide by 20 ft. long, and its steelwork ties into the station framing. The main columns were 6-in. I-beams supported on concrete foundations in the station yard.

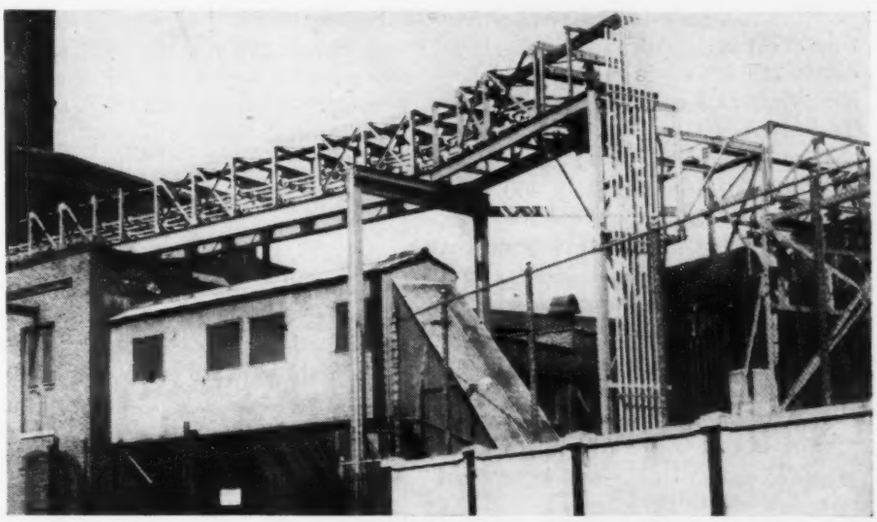


FIG. 1—Steel structure in station yard carries control wiring conduits at top and generator-transformer cable ties below. Clearance is 26 ft. above ground

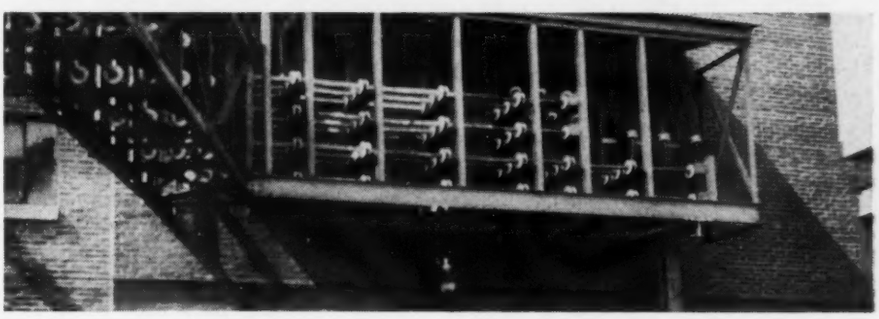
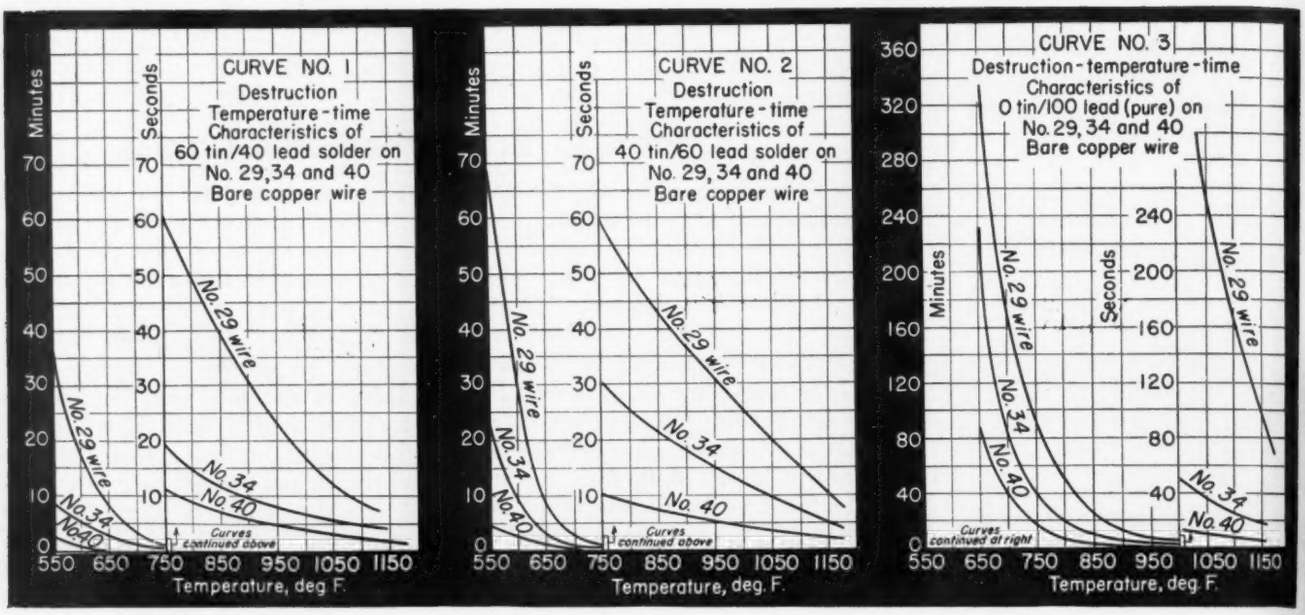


FIG. 2—Close-up view of structure carrying generator cables from within plant to outdoor transformers at point where conductors leave station

High Temperature Solder Effect on Copper Wire



RATE OF DESTRUCTION with increase in temperature for three representative small wires and three compositions of solder

Proof that commonly used high-temperature molten solders have destructive effect on copper wire has been discovered by engineers of the Fairchild Camera & Instrument Corp., New York, N. Y.

Data from wire life or destruction time tests of approximately 400 samples of bare copper wire have been plotted in the accompanying curves which represent average values for each test condition. Variables considered for the tests were: (1) Three wire sizes selected as representative of the more commonly used small and fine wires; (2) three tinning solders to give an approximate general working range down to pure lead; (3) solder temperature ranges of 550 to 1175 deg. F.

Greatest rate of change in destruction time with temperature change occurs in the range of approximately 550 to 750 deg. F. for 60/40 and 40/60 solders, and 650 to 950 deg. F. for pure lead.

Three major conclusions are:

1. The life and diameter of any small to fine size copper wire in any solder is decreased with increasing molten solder temperatures.

2. The higher the tin content of tin/lead solder, the shorter is the life of a given wire in that solder for any given solder temperature. Unfortunately, however, an all-lead solder results in a considerably weaker solder joint than tin/lead solders.

3. For a given solder composition and solder temperature, the finer the wire size (diameter), the shorter is the wire life in the solder.

Further conclusions to the tests are:

The all-around best solder of those tested appears to be the 40/60 combination, commonly referred to as soft solder. Other solders in this vicinity may offer even better properties. For certain other purposes, regardless of these findings, hard or 60/40 solder may be best.

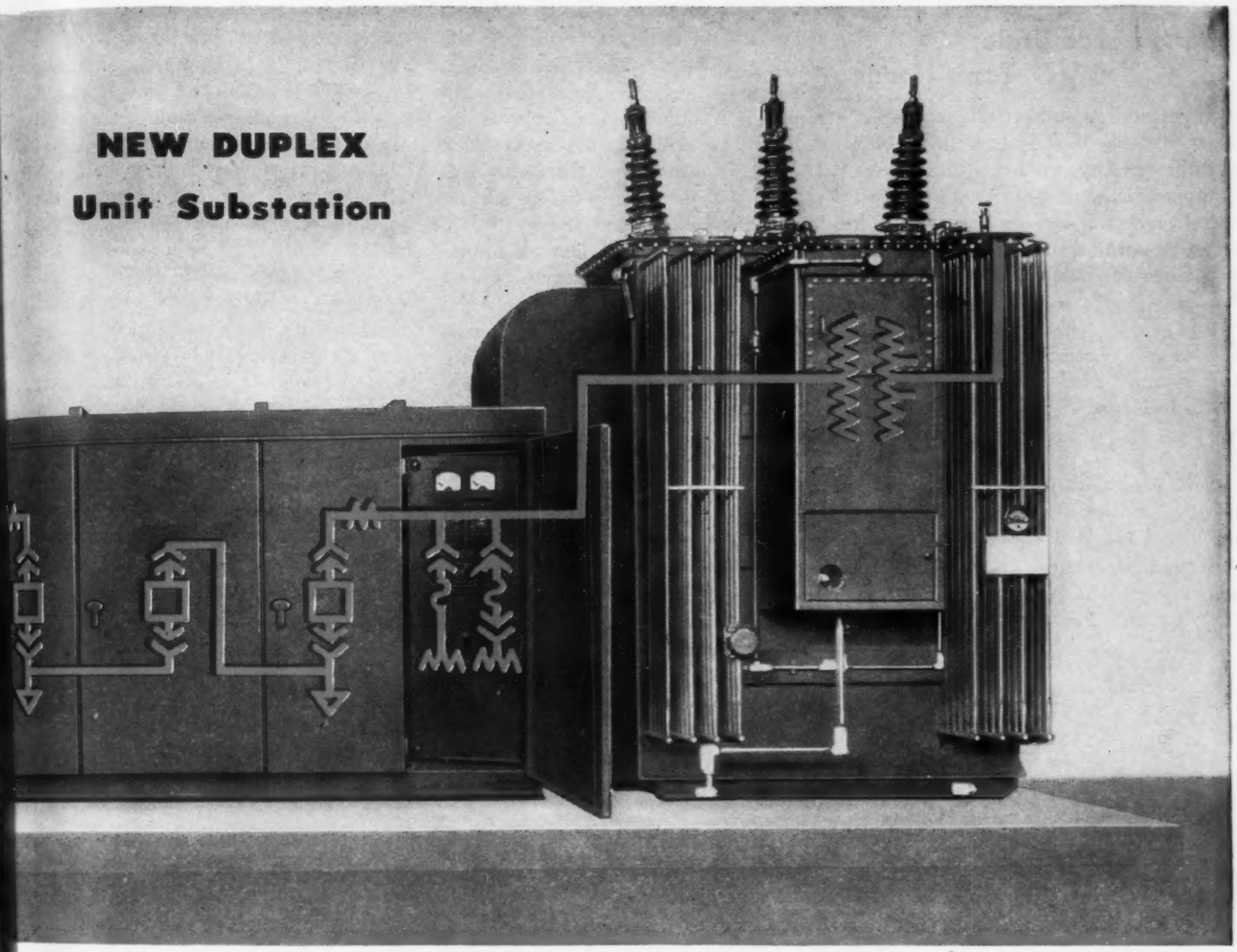
Some form of wire weakening or loss of tensile strength, broadly classified as embrittlement, may be imparted to copper wire from tin/lead solders in the 1,000 deg. F. temperature range.

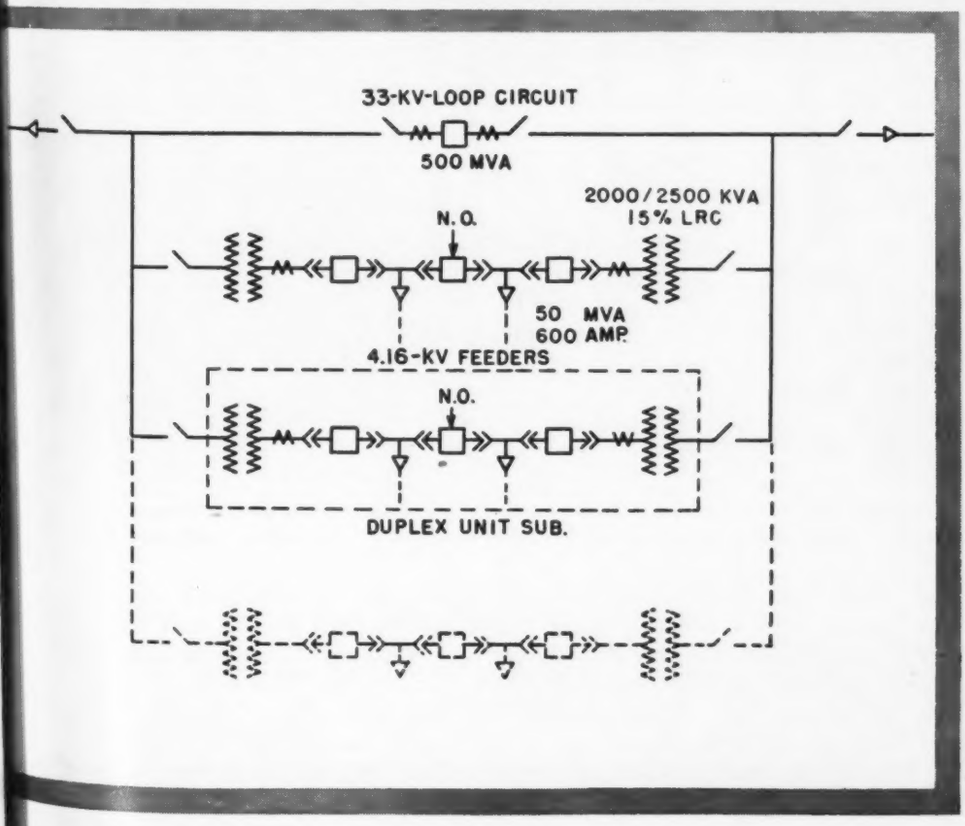
On the basis of these facts only, it is apparent that a low solder temperature should be used for tinning and/or making joints on wire sizes finer than approximately No. 30-32. Preferably, these solder temperatures should be kept either within 160 to 200 deg. F. above the melting or liquid point of the solder used, or under 600 deg. F. For Formex or Formvar coated wires, a low temperature insulation stripping method (see ELECTRICAL WORLD, March 3, 1945, page 116) other than the hot tin dip method now becomes necessary. Other methods, involving high temperatures, such as the gas flame method, tend to introduce wire embrittlement and copper oxidation, and are no better.

•

Clean Compartments

DIRT IS PREVENTED from entering the metal clad switchgear compartments in the Westfield, N. Y., municipal plant by a 1½-in. angle iron barrier at the floor line. A short piece of ¼-in. steel bar is welded to each end for stops. It is easily removable, when necessary, when rolling out the switch





Relaying is so arranged that, if voltage disappears at the secondary of one transformer, the breaker on that side immediately opens and the tie breaker automatically closes, restoring service in approximately 105 cycles.

The DUPLEX provides a "building block" approach to the construction of standard substations which have a degree of operating flexibility heretofore obtained only by special engineering and construction. Small or large substations can be economically made up of the same basic unit. A single DUPLEX unit can be installed at first, and as the load grows, additional units can be added when they are needed.

UNIT SUBSTATIONS

Fire Hazards Under Tank Hoods

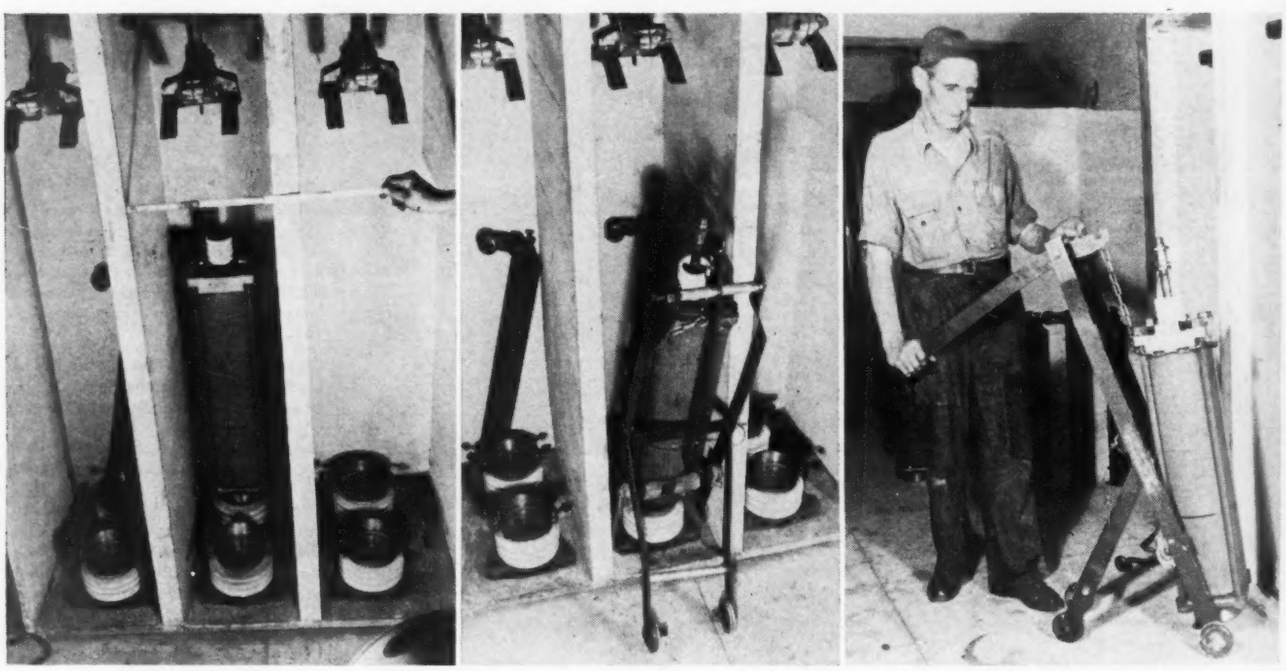
In a modern industrial plant seven adjacent tanks containing solutions for cleaning small aluminum forgings were equipped with an 8-ft. by 27-ft. sheet metal ventilating canopy beneath which was a monorail transport system having two 220-volt, rail conductors and two 0.5-ton electric hoists driven by inclosed motors. The hoists passed over the tanks and received energy through two spring-loaded contact pulleys beneath the hood. The hoists are moved horizontally by pulling an extended lever and are used for raising and lowering baskets of forgings. There are three vapor-proof electric lights under the hood supplied through pipe conduit located outside. Each basket is about 4 ft. by 2 ft. by 10 in., holding 350 lb. The hoists carry the baskets from tank to tank and return to the starting position by an elliptical path. While a basket of forgings was being dipped in a sodium hydroxide solution, flame broke out over the tank and a 15-lb. carbon dioxide extinguisher was used to put out the fire before sprinklers at the ceiling operated.

Hydrogen evolved when aluminum and sodium hydroxide are in contact was ignited by electric sparks from the overhead hoist. An investigation by the Associated Factory Mutual Fire Insurance Companies indicated the unsuitability of the existing electrical equipment under the sheet metal hood over the cleaning tanks where hydrogen gas is present. The spring-loaded contact pulleys spark whenever the hoisting equipment is operated and are a definite source of ignition for the hydrogen gas, small though the amount present in this process was. Examination indicated no practicable method of rearranging the present hoisting equipment to eliminate sparks, and it appeared essential to remove the existing electrical conductors and spring-loaded contact pulleys under the hood. All electrical equipment under the hood, it was pointed out, should be made as nearly explosion proof as possible. A safe method of supplying energy to hoists under the hood appeared difficult, but it appeared practicable to consider the use of heavy duty rubber insulated conductors and an automatic winding reel to take up the slack in the conductors as the hoists move on the elliptical shaped monorail. Manually operated or compressed air hoists should be considered, although it was not maintained that this drastic solution was the only way out. Automatic temperature control was advised for the sodium hydroxide solution.

• • •

Oil Switch Tank Lifter

R. R. RIDGELY, *Electrical Maintenance Foreman, Southern California Edison Co., Long Beach, Calif.*



TOGGLE OPERATED chain grab switch tank lifter. Left: Dimensions of switch cell make removing and replacing tanks difficult and hazardous. Center: Lifter raises 200 lb. tank clear of bushings ready for removal. Right: Details of toggle-operated chain grab

Development of a switch tank lifter has eliminated considerable strenuous labor and made removing and replacing oil switch tanks much safer at the Long Beach Steam plant of Southern California Edison Co. The wheeled cradle illustrated was made especially for handling the tanks of G. E. types H203 and H206, 15-kv. oil switch tanks. Factors affecting design were: weight of tank, approximately 200 lb.; switch cell width and depth, 13½ by 28 in.; presence of bushings on cell floor which must be cleared.

As may be seen from the illustrations, these conditions were met by: constructing a toggle-operated chain grab with a positive lock which lifts and holds the tank against the cradle; limiting the width of the cradle and installing wheels to provide easy movement; fastening the wheels with short bolts instead of axles to clear the floor bushings.

Deltabeston

FIXTURE WIRE IS IDEAL

Here are five features to help make your lighting fixture customers more satisfied. You gain all these advantages when you wire with Deltabeston, Type AF.

HEAT RESISTANCE

● Deltabeston is insulated with a wall of felted asbestos. It stops wire failures in hot lighting fixtures.

MOISTURE RESISTANCE

● Deltabeston's insulation is impregnated with moisture-resistant compounds. It ends short circuits caused by moisture in fixtures.

LASTING FLEXIBILITY

● Deltabeston withstands abrasion, twisting and sharp bending. You can forget all about rupturing the insulation.

SMOOTH FINISHES

● Deltabeston's smooth and slippery finish helps speed up the wiring of lighting fixtures and installations.

EASY STRIPPING

● Deltabeston strips clean and easy. The insulation cannot be pushed back on the conductor.

The new Deltabeston Fixture Wire, Type AF is ideal for all types of conventional fluorescent lighting units. It is designed for high wattage lighting fixtures especially where high ambient temperatures and humidity are present. Deltabeston is fully approved for wiring fluorescent lighting fixtures even with temperatures exceeding 90 dedegrees C (194 F).

Get the whole story about Deltabeston Wires and Cables by writing to Section Y262-9 Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn. All Deltabeston Asbestos, Glass and Synthetic-insulated Wires are distributed nationally by Graybar Electric Co., General Electric Supply Corp., and other G-E Merchandise distributors.

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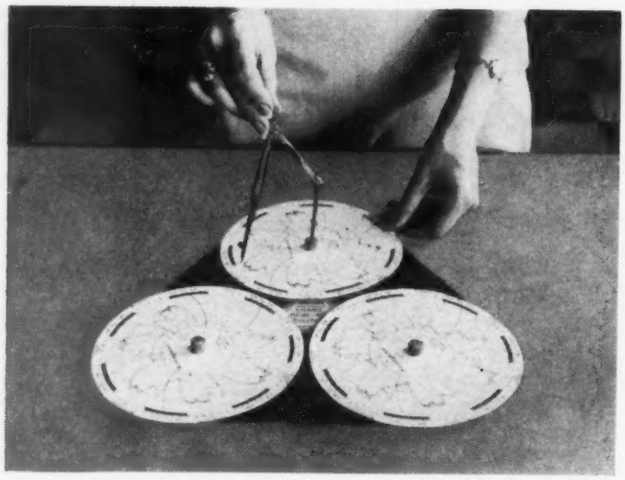
Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EST, NBC. "The World Today" news every weekday 6:45 P.M. EST, CBS. "G-E House Party" Monday through Friday 4:00 P.M. EST, CBS.

GENERAL ELECTRIC

THREE WAYS to Speed Up Chart Reading and Folding

Three labor saving devices expedite reading and folding of approximately 340 circular charts, 35 strip load charts and 27 demand charts received each month—The devices were conceived, designed and built by the Planning Division of the Indianapolis Power & Light Co.

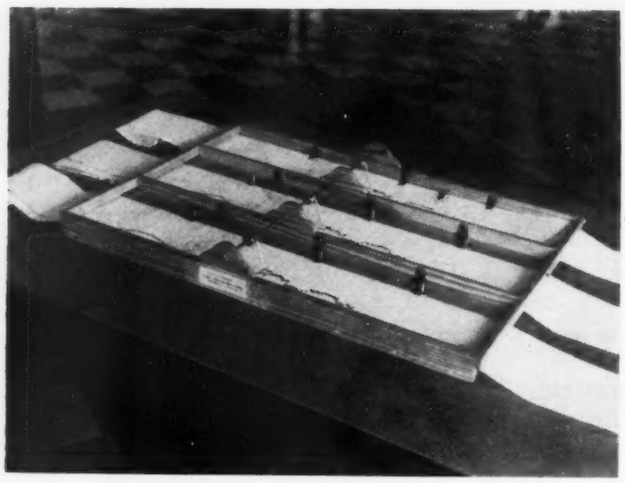
ANN PAYNE, Engineering Department, Indianapolis (Ind.) Power & Light Co.



1. Reading Board for Circular Charts (known as "The Ouija Chart Reading Facilitator"). This board facilitates the reading of circular load and voltage charts for all three phases.

Triangular board accommodates three charts at one time. A compass point is placed in the center of the dowel and the lead or other point is put on a high peak. Then the chart is rotated under the compass and higher peaks are immediately ascertained.

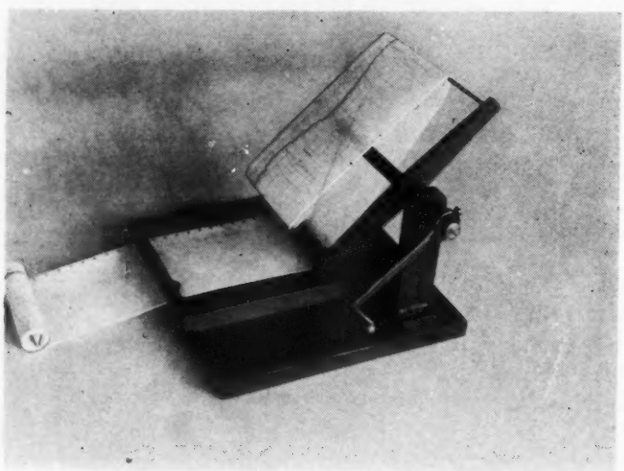
This procedure speeds up reading, reduces fatigue due to eye strain and prolonged concentration. Results have shown a decrease in errors.



2. Reading Board for Strip Charts (known as "The Little Wonder Chart Reading Facilitator"). This board does for the 170-in. long strip charts what "Ouija" does for the circular charts.

Board has three troughs in which charts are kept in order and are threaded from left to right. Charts for all three phases show at once. Indicators are on a rod in the middle, are set on a peak and then to a higher peak, when found. Ammeter charts are narrower than kw. and kvar. demand charts, hence adjustment pegs are provided.

This device saves time in handling awkward charts and reduces fatigue in reading.



3. Winding Board for Strip Charts (known as "The Little Wonder Chart Winding Facilitator"). This device prepares the 170-in. long charts in a form suitable for filing and titles can be placed in a uniform position.

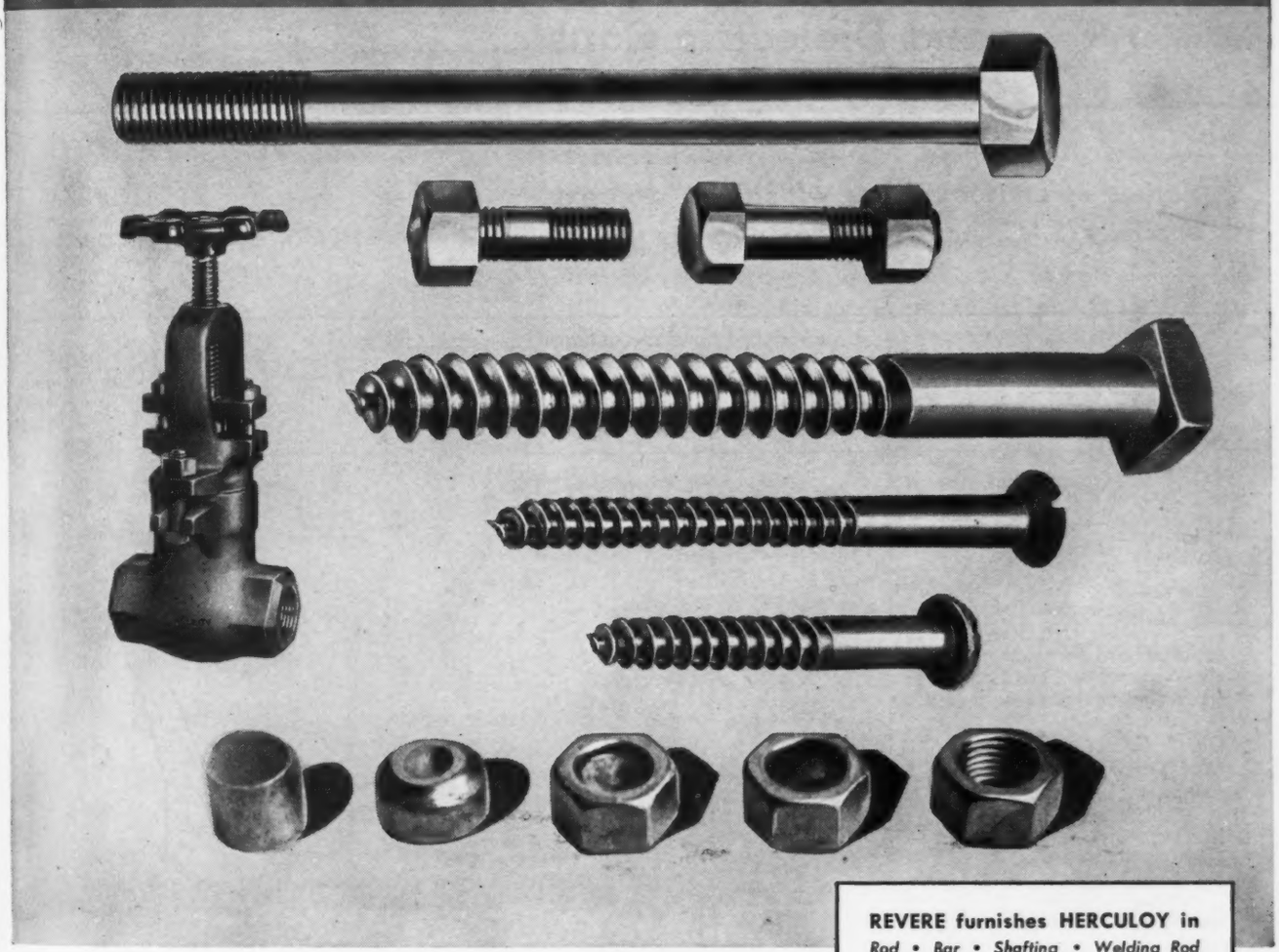
Board base has a horizontal frame through which chart is fed. Adjustment pins allow the accommodation of three sizes or widths of charts. Rotating frame winds chart as rapidly as the handle is turned and then the strip is slid off the frame in a round form for folding and filing.

Previously the strip charts were folded around a $8\frac{1}{2}$-in. x 11-in. cardboard, which was tedious and slow, but now are folded in a few seconds by this new method.

REMEMBER THAT HERCULOY OFFERS THE ELECTRICAL INDUSTRY

• THE STRENGTH OF MILD STEEL

• THE CORROSION RESISTANCE OF COPPER



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Sheets • Plates • Rolls • Strips • Tube
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HERCULOY is the name applied to improved copper-silicon alloys made by Revere. These alloys have the strength of mild carbon steel, plus the corrosion resistance of copper, and hence are exceedingly valuable in stressed parts subject to corrosive influences such as moist air, sea water, contaminated or corrosive natural waters, and industrial wastes, many of the acids, alkalis and other process chemicals.

In the electrical industry, Herculoy bolts, nuts, washers, U bolts, lag and wood screws and similar parts have found wide application in transmission lines, construction of catenary suspensions for electric railroads, and in power plants and substations. In steam plants Herculoy has found a great variety of uses, including packing gun cylinders for expansion joints, shafting for water pumps, valves and valve stems.

Herculoy can be easily hot or cold worked, drawn, welded, spun, stamped, machined and otherwise manipulated by standard methods. To benefit to the utmost from these high-quality Herculoy alloys, consult Revere.

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ELECTRICAL INSULATING MATERIALS

Power Factor-Temperature Characteristics and Dielectric Constant (S.I.C.)

Values of characteristics which are approximate and the specific inductive capacity (S.I.C.) have been compiled by the Doble Engineering Co., Boston, Mass.

Material	Percent Power Factor at 60 Cycles — Temperature, Deg. C.										Dielectric Constant S.I.C. †
	20	25	30	40	50	60	70	80	90	100	
1. Air	.....	....	....	....	....	....	....	....	....	....	1.0
2. Compounds and Greases	.....	....	....	....	....	....	....	....	....	....	....
(a) Minerallac No. 1	.....	....	1.0	....	....	5.0	....	....	50.0	....	2.7
(b) No. 2-A	.....	....	1.0	....	....	4.0	....	....	16.0	....	2.8
(c) No. 64	.....	....	1.0	....	....	3.0	....	....	20.0	....	2.9
(d) No. 78	.....	....	1.0	....	....	6.0	....	....	20.0	....	2.7
(e) No. 104	.....	....	2.0	....	....	12.0	....	....	65.0	....	2.8
(f) No. 104-A	.....	....	3.0	....	....	25.0	....	....	70.0	....	2.5
(g) Standard Petrolatum	.....	0.3	....	0.3	....	0.6	....	1.2	....	1.9	2.2
(h) Waterwhite Petrolatum	.....	0.3	....	0.3	....	0.3	....	0.3	....	0.5	....
(i) Standard Petrolatum plus 22 percent rosin	.....	0.5	....	....	....	....	....	....	....	6.6	....
3. Glass	.....	....	....	....	....	....	....	....	....	....	....
(a) Crown	1.0*	....	....	....	....	....	....	....	....	....	6.2
(b) Flint	1.4*	....	....	....	....	....	....	....	....	....	7.0
(c) "Fiberglas" cloth	.....	3.0	....	3.0	3.2	3.5	5.5	6.5	8.0	10.0	....
4. Marble	4.5*	....	....	....	....	....	....	....	....	....	8.0
5. Mica	.....	....	....	....	....	....	....	....	....	....	....
(a) Amber	0.4	....	....	0.5	....	0.7	....	1.2	....	8.0	7.1
(b) Green	0.3	....	....	0.4	....	0.5	....	0.6	....	1.2	7.1
(c) Ruby	0.2	....	....	0.2	....	0.3	....	0.3	....	0.3	6.1
6. Oil, transformer	0.1	....	0.16	0.24	0.36	0.59	0.83	1.1	....	....	2.1
7. Pyranol	0.3–14.0*	....	....	....	....	....	....	....	....	....	4.5
8. Paper	.....	....	....	....	....	....	....	....	....	....	....
(a) Kraft, dry	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.0
(b) Herkolite	0.8	....	0.8	0.9	1.0	1.5	2.8	4.5	7.5	12.0	4.0
9. Porcelain (wet process)	2.0	....	2.8	3.8	5.6	8.5	13.0	....	....	....	7.0
10. Rubber	.....	....	....	....	....	....	....	....	....	....	....
(a) Hard	1.0*	....	....	....	....	....	....	....	....	....	2.5
(b) Kerite, cable	5.4	....	4.8	4.4	4.1	4.2	....	....	....	....	3.6
11. Shellac	2.5*	....	....	....	....	....	....	....	....	....	3.3
12. Slate	1.0*	....	....	....	....	....	....	....	....	....	7.0
13. Soapstone	1.3*	....	....	....	....	....	....	....	....	....	7.3
14. Varnished-cambric tape	.....	....	....	....	....	....	....	....	....	....	4.5
(a) Joints, 1937	2.7	....	2.8	2.9	3.0	3.4	4.3	6.0	9.5	....	....
(b) Joints, 1931	3.1	....	3.2	3.4	3.6	3.9	4.4	5.0	6.3	7.5	....
(c) Joints,* before 1931	3.6	....	4.9	6.2	7.5	9.1	11.3	14.0	17.5	21.8	....
(b) Joints, before 1931	8.0	....	9.5	10.5	11.1	11.5	13.2	16.1	22.4	42.5	....
(e) Cable, before 1939	.....	....	8.0	8.2	8.4	8.6	9.0	9.8	11.2	14.0	....
(f) Cable, 1939	.....	....	6.0	6.0	6.2	6.4	6.8	7.5	8.5	10.0	....
15. Water	.....	....	....	....	....	....	....	....	....	....	81.1

* Temperature and/or test frequency not given but assumed to be 20 deg. C. and 60 cycles.

† S.I.C. values listed are the average value where the source of reference showed more than one value.

HOW TO PUT PERFORMANCE INTO YOUR LOW-VOLTAGE LINES

Nothing but air separates the conductors of a distribution line from the full fury of next summer's lightning. When it strikes, the small pintype insulators must withstand tremendous abuse and survive. This is a big order!

And we can carry this a lot further. The condition is repeated thousands of times on the average system... Distribution lines are those that bring power home to the customer, and on which the power company is judged and public relations founded... Lastly, emergency repair is just as troublesome and almost as costly as if the line were carrying many times as much voltage.

It all adds up to the fact that distribution materials have a hard job cut out for them and that the best is none too good. With O-B insulators and hardware for this service, you get the great advantage of high-voltage experience, facilities, and point of view brought to the low-voltage field where it has been urgently needed.

You can approach transmission line reliability on your low-voltage distribution circuits when you build throughout with O-B materials.

2644-H

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Ohio Brass

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Air Conditioning Costs for Theaters

Costs of owning and operating an air conditioning system in a theater can be translated into terms of increased income necessary to liquidate the investment within a given period (say five years).

Approximate average installation costs are given below for various theater arrangements. The figures are derived from a large number of actual installations.

Assumptions

1. Liquidate total investment in 5 years.
2. Cover 6 percent interest on unliquidated investment.
3. Cover insurance, taxes and maintenance.
4. Allow 2 cents per kw.-hr.
5. Allow $1.50 per 1,000 cu. ft. of water.
6. Assume a 17½-week summer.

Example—A type 3 installation in a theater having 1,000 seats and showing three pictures per week would cost $50.40 per picture. At 30-cent admission charges, this means 168 additional admissions per picture to pay for the air-conditioning.

(Adapted from notes of lecture prepared by Bertram B. Reilly, Dravo Corp., Pittsburgh, for presentation to industrial power salesmen of Duquesne Light Co., Pittsburgh.)

APPROXIMATE COST PER PICTURE OF THEATER AIR CONDITIONING

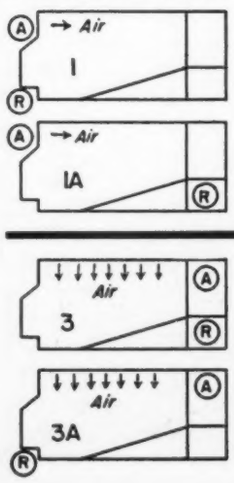
(Based on above assumptions and on running 4 shows per day)

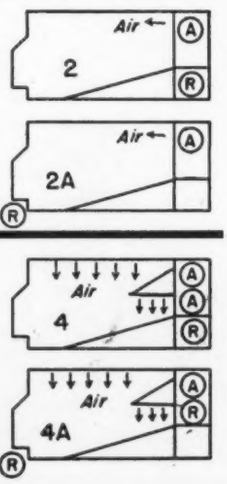
Theater Type		1			2			3			4		
Seats	Pictures per Week	7	3	2	7	3	2	7	3	2	7	3	2
500	Power Cost	3.20	7.40	11.00	3.20	7.40	11.00						
	Water Cost	1.30	3.00	4.50	1.30	3.00	4.50						
	Miscellaneous	.60	1.30	2.00	.60	1.30	2.00						
	Operating Charges	5.10	11.70	17.50	5.10	11.70	17.50						
	Capital Charges	6.50	15.00	22.50	6.50	15.00	22.50						
	Total	11.60	26.70	40.00	11.60	26.70	40.00						
700	Power Cost	4.30	10.00	15.00	4.30	10.00	15.00						
	Water Cost	1.70	4.00	6.00	1.70	4.00	6.00						
	Miscellaneous	.60	1.30	2.00	.60	1.30	2.00						
	Operating Charges	6.60	15.30	23.00	6.60	15.30	23.00						
	Capital Charges	7.80	18.00	27.00	7.80	18.00	27.00						
	Total	14.40	33.30	50.00	14.40	33.30	50.00						
1,000	Power Cost	.....	.....	.....	5.40	12.70	19.00	5.40	12.70	19.00	5.40	12.70	19.00
	Water Cost	.....	.....	.....	2.20	5.00	7.50	2.20	5.00	7.50	2.20	5.00	7.50
	Miscellaneous	.....	.....	.....	.70	1.70	2.50	.70	1.70	2.50	.70	1.70	2.50
	Operating Charges	.....	.....	.....	8.30	19.40	29.00	8.30	19.40	29.00	8.30	19.40	29.00
	Capital Charges	.....	.....	.....	10.30	24.00	36.00	13.40	31.00	46.50	16.20	37.70	56.50
	Total	.....	.....	.....	18.60	43.40	65.00	21.70	50.40	75.50	24.50	57.10	85.50
1,400	Power Cost	.....	.....	.....	7.30	17.00	25.50	7.30	17.00	25.50	7.30	17.00	25.50
	Water Cost	.....	.....	.....	2.90	6.70	10.00	2.90	6.70	10.00	2.90	6.70	10.00
	Miscellaneous	.....	.....	.....	1.00	2.40	3.50	1.00	2.40	3.50	1.00	2.40	3.50
	Operating Charges	.....	.....	.....	11.20	26.10	39.00	11.20	26.10	39.00	11.20	26.10	39.00
	Capital Charges	.....	.....	.....	14.00	32.50	48.50	17.50	40.70	61.00	20.60	48.00	72.00
	Total	.....	.....	.....	25.20	58.60	87.50	28.70	66.80	100.00	31.80	74.10	111.00
2,000	Power Cost	.....	.....	.....	10.20	23.70	35.50	10.20	23.70	35.50	10.20	23.70	35.50
	Water Cost	.....	.....	.....	4.00	9.40	14.00	4.00	9.40	14.00	4.00	9.40	14.00
	Miscellaneous	.....	.....	.....	1.20	2.70	4.00	1.20	2.70	4.00	1.20	2.70	4.00
	Operating Charges	.....	.....	.....	15.40	35.80	53.50	15.40	35.80	53.50	15.40	35.80	53.50
	Capital Charges	.....	.....	.....	20.00	46.50	69.50	25.00	58.40	87.50	28.00	65.00	97.50
	Total	.....	.....	.....	35.40	82.30	123.00	40.40	94.20	141.00	43.40	100.80	151.00

APPROXIMATE INSTALLATION COSTS PER SEAT FOR TYPICAL THEATERS

SEATS	PER SEAT
500	$17.50
700	15.00
500	18.50
700	16.00
1,000	14.00
1,400	13.50
2,000	13.50

Add $1.00 per seat





SEATS	PER SEAT
500	17.50
700	15.00
1000	14.00
1400	13.50
2000	13.50

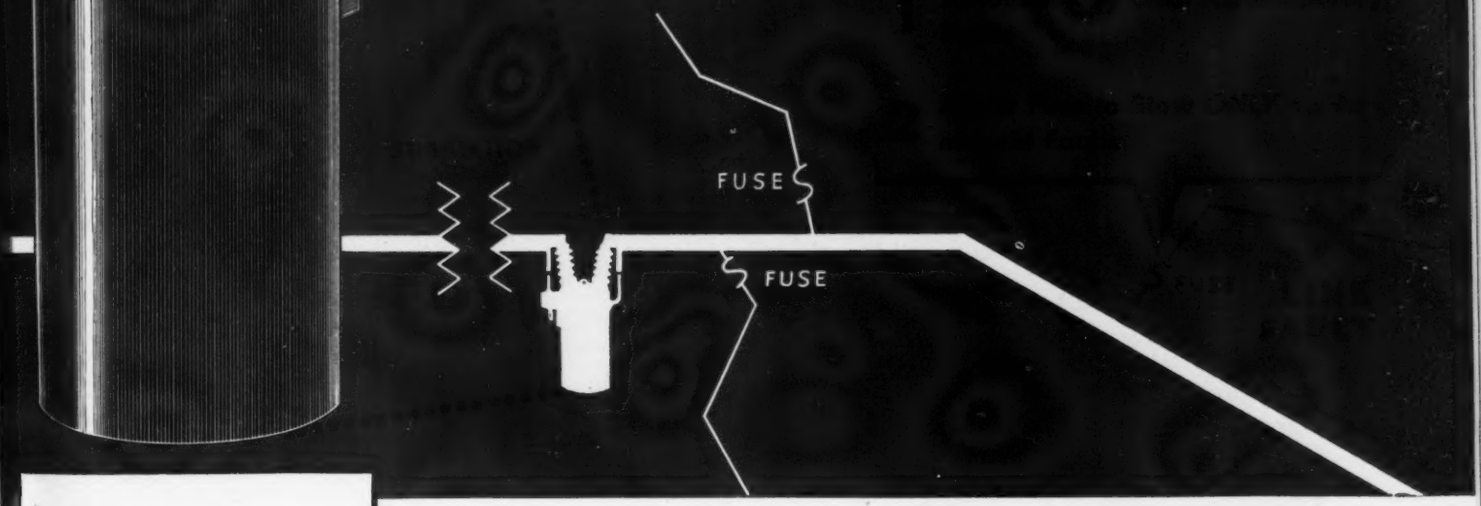
Add $1.00 per seat

1,000	22.00
1,400	20.00
2,000	19.00

Add $1.00 per seat

(A) Location of Air Conditioning Unit.
(R) Location of Refrigeration Unit.

Only KYLE CIRCUIT RECLOSERS PROTECT THIS SYSTEM TWO WAYS



KYLE FEATURES

Hydraulic Control Mechanism . . . Provides accurate timing on all Recloser Operations.

Double, Fast-Acting Contacts . . . Prevent burning of contact surfaces by high speed action.

Recloser is Triple Safe . . . Operating handle and tank always dead. No terminal in bottom of tank. Normal position of Recloser is open.

Recloser Ratings . . . Voltage: 2400 to 15,000; Ampere Rating: 5 to 50; Minimum Tripping Current: 10 to 100 Amperes; Interrupting Capacity: 150 to 1200 Amperes. Rating changed by replacing series trip coil.

Kyle Type "H" Oil Circuit Reclosers are timed to provide fast opening on the first two operations . . . time-delay opening on the third and fourth operations.

The two fast openings automatically clear all temporary line faults, such as those resulting from lightning or falling tree limbs, without damage to branch line fuses.

The time-delay openings of the Kyle Recloser permit the branch line fuse to blow ONLY on permanent faults . . . faults that cannot be cleared by the two fast openings. This isolates the affected branch line and maintains service on the rest of the system.

After opening one, two, or even three times, the Kyle Type "H" Recloser automatically resets for another complete cycle of operations. A permanent fault on the main line will cause the Recloser to lock open after the fourth operation.

This TWO-WAY automatic protection, which only Kyle Type "H" Reclosers can offer, results in better continuity of service, more satisfied customers and reduced maintenance cost.

Your Line Material Representative can give you complete information on how you can provide your lines with this Kyle Two-Way Protection.

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

Inductive Pick-up for Fault Location

G. L. DANNER
Chief Electrician, Jefferson Proving Ground, ASF Ordnance Department, Madison, Ind.

Increased use of underground cables for both primary and secondary electric service makes the development of simple inexpensive fault locating devices a necessity.

As 95 percent of the electric service at Jefferson Proving Ground is underground, we have been vitally interested in all published information on the subject. Most systems seemed to us to be too complicated and expensive. We therefore attempted to develop our own system.

Early experiments here resulted in the use of modulated radio frequency (see ELECTRICAL WORLD, January 20, 1945) with surprisingly good results, that is, as long as the faults were in non-metallic cables. This system proved totally inadequate for the location of faults in lead or armored cables. However, the use of modulated radio frequency still seems to be the best method of locating open circuits or cut cables.

The use of magnetic induction seemed the most desirable, so a magnetic pick-up was built using an iron core made of No. 26 gage soft iron

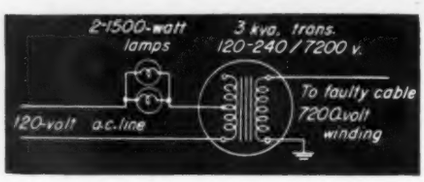


FIG. 2—Faults broken down by 7.2-kv. transformer with lamps in 120-volt secondary to limit fault current

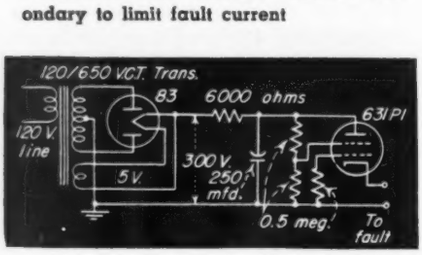


FIG. 3—Impulse generator furnishes tracer current for low resistance faults

laminations, built up to form a bar one inch square by eight inches long. A coil of approximately 5,000 turns of No. 30 magnet wire was wound around this core. The entire assembly was then mounted in a small wooden box with a handle.

We then built a small compact battery-powered three-stage audio amplifier. The schematic diagram (Fig. 1.) is self explanatory. A pair of head phones completes the pick-up system.

The problem of securing a satisfactory tracer current has not been so simple. As all cable faults did not reduce to low resistance values, some

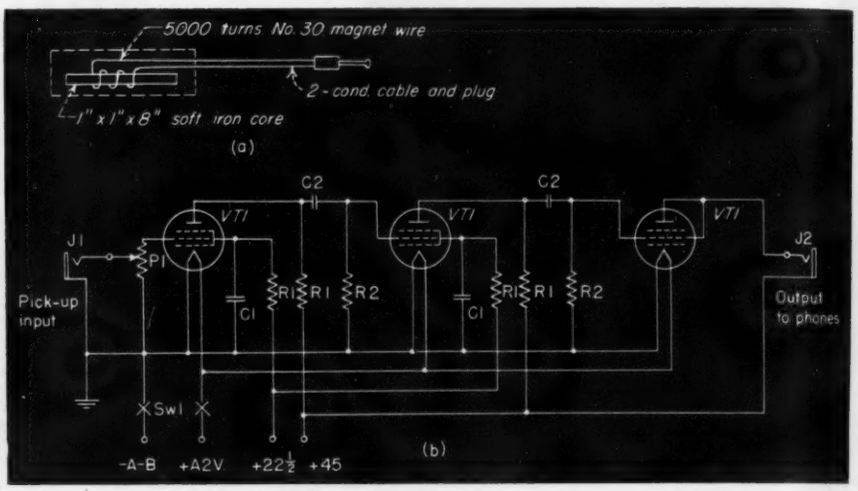


FIG. 1—Pick-up (a) search coil and (b) amplifier

P1 = 1 megohm potentiometer	R1 = 0.25 meg.	C2 = 0.01 mid.	SW1 = 2 P. S. T. switch
C1 = 0.05 mfd.	R22 = 1 meg.	VT1 = Type 32 tube	
	J2 = Insulated jack		

means had to be devised to cause them to break down. A transformer with two 1,500-watt light bulbs connected in parallel and then connected in series with the 120-volt terminals of a 3-kva. 120-240/7200-volt transformer with the high voltage terminals connected to the faulted lines worked in most cases. This also provided a satisfactory tracer current. The series lamps served to limit the current in the cable and prevented damage to the transformer due to high currents (connections, Fig. 2).

The simplest and one of the most satisfactory methods of getting a tracer current is with the small impulse generator shown in Fig. 3. The entire outfit does not weigh over 10 lb. A limiting factor on the use of the impulse generator is that the fault must be reduced to a resistance of 300 ohms or less to get a satisfactory impulse.

Once a satisfactory tracer current is established it is only a matter of walking the line carrying the pick-up and amplifier to locate the fault. A sharp decrease in the volume usually indicates its location.

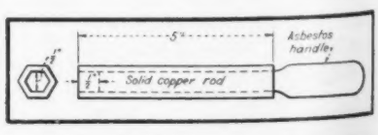
The pick-up is very sensitive and has been used on numerous occasions to locate a cable that was in service but whose exact location was not known.

• • •

Tool Unsolders Nut on Demand Meter Post

A tool which is a combination "soldering device" and socket wrench is a handy implement to have on the meter repair bench. One operation in which it has more than paid for itself is in removing the soldered nut from the reset post on Westinghouse demand meter covers when installing a serial adapter.

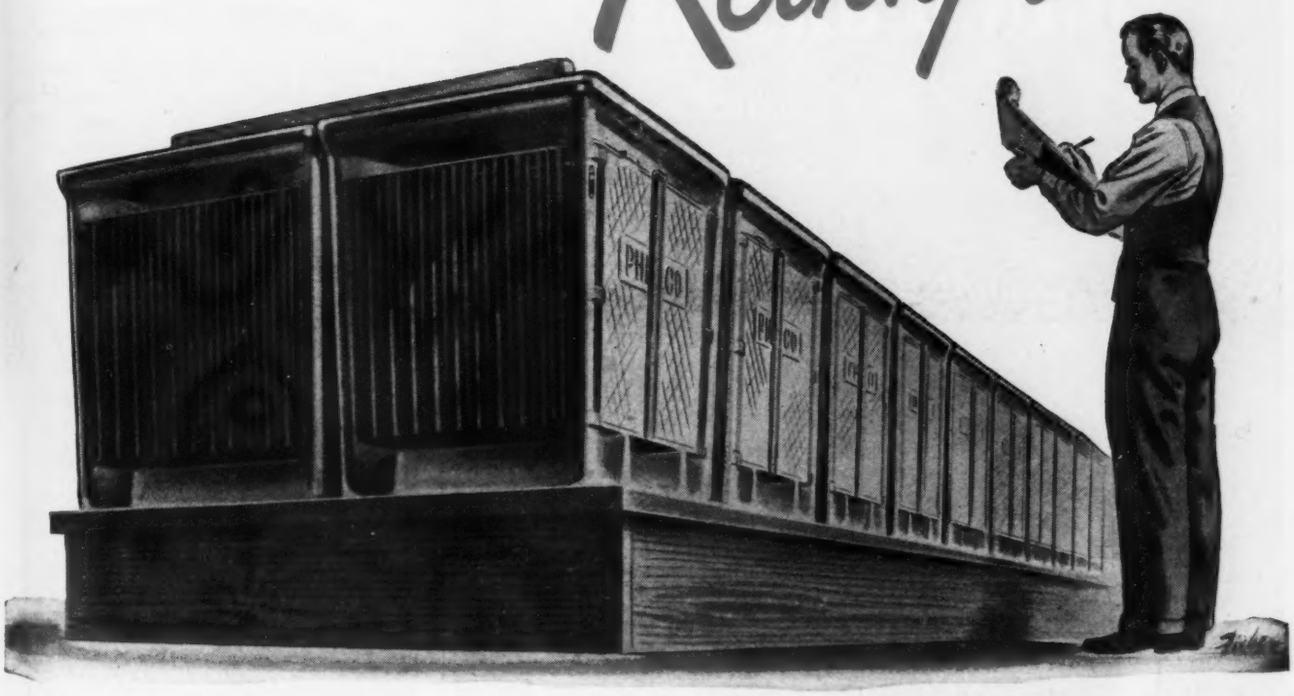
Previous to making and using this tool, the nut was removed by the use of a soldering iron and a pair of pliers. This often necessitated heating the iron twice and always presented the problem of using the pliers in an awkward position.



COMBINATION hexagon socket wrench and soldering device is made of copper rod with an asbestos handle

This tool devised by Frank E. Griffith of the meter department of Philadelphia Electric Co. simplified this operation. It is made of one 5-in.

Is Your Battery Room Ready?



Do you have adequate auxiliary power and control facilities for the expanded service you are planning? Are battery replacements, new batteries, new layouts needed? Philco battery engineers are at your service—ready with more than fifty years of experience in storage battery engineering, planning and installation. Ready with the most modern batteries obtainable—the famous Philco Floté Batteries in glass, rubber or Vitrabloc jars. Write for new catalogs of specification data. Specify Philco. PHILCO CORPORATION, Storage Battery Division, Trenton 7, New Jersey.

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Better Performance
All-weather Service
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Complete Satisfaction

Ask for Bulletin No. 114

2500 KVA, 3 phase, 60 cycles, Type AP, non-inflammable askarel-cooled power transformer. 12000 volt cover mounted primary, 480 volt secondary with terminal chamber.

R.E. UPTEGRAFF Manufacturing Co.
SCOTTDALE · · PENN'A · U·S·A·
NEMA MEMBER

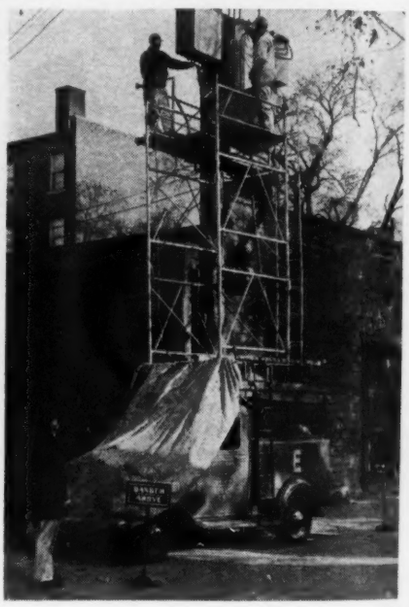
piece of copper rod formed at one end to make a half-inch hexagon wrench and has a 3-in. asbestos handle at the other end. The tool is heated, placed over the nut (waiting an instant for the solder to soften) and then the nut is turned off, all in one simple operation.

•

Flow-Paint Overhead Network Transformers

F. C. POHL
Superintendent of Substations
The Detroit Edison Co., Detroit, Michigan

Painting transformers and associated equipment that are mounted on poles is a difficult job at best. The



FLOW PAINTING a pole-mounted transformer on Detroit's low voltage a.c. network system; also used on bare metal

situation is further aggravated when radiating tubes of transformers hide points that are inaccessible with a paint brush. These handicaps have been largely overcome by the use of flow-painting on the low voltage a.c. network system of Detroit Edison.

Manner in which the work is done is shown in the accompanying illustration. A funnel-type catch basin suspended below the transformer contains a supply of paint. This is led through a hose from the bottom of the basin to a motor-driven pump, midway up the scaffold, and then back to the painter. A continuous flow of paint from the hose reaches all surfaces, including underside of tubes.

The work is efficient and safe. When

Take your time, lieutenant . . . this GOLD SEAL's got a good grip on him

Other Jenkins Bros. tape products include Diamond Seal Friction and Rubber Tapes, which meet ASTM and Federal specifications.

Actually, every single roll of Jenkins Gold Seal Tape has exceptional grip and staying power simply because it's got more tensile strength in the fabric, more live rubber in the friction compound.

That's not boasting . . . that's testing . . . every lot of the base cloth, every batch of the friction compound. The Jenkins laboratory asks more of every roll of Gold Seal than you'd ever think of demanding.

Every step of the whole process gets that kind of scientific control. Cloth and compound are made one so that there's never any raveling or peeling. And it doesn't dry out.

Then each perfectly made roll is wrapped in cellophane so that when you point to the big red Gold Seal box on your dealer's shelf, you always get the best friction tape at its factory fresh best. Jenkins Bros., Rubber Division, 80 White Street, New York 13, New York.

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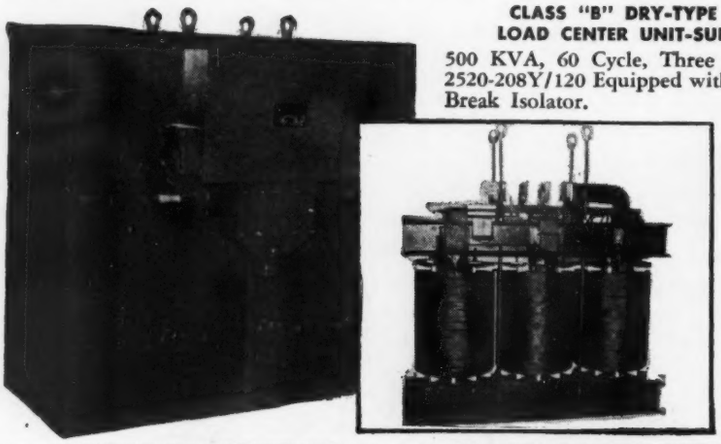
FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

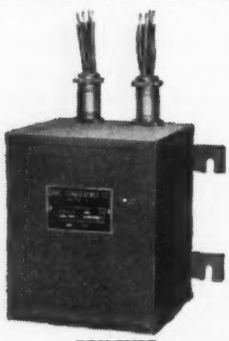
DAVIS TRANSFORMERS



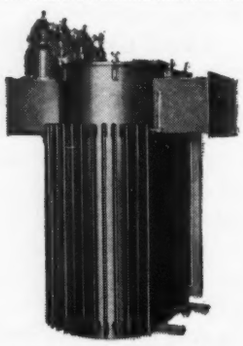
CLASS "B" DRY-TYPE LOAD CENTER UNIT-SUB
500 KVA, 60 Cycle, Three Phase, 2520-208Y/120 Equipped with Load Break Isolator.

OIL COOLED DISTRIBUTION
100 KVA, 2400/4160Y-120/240, Single Phase, 60 Cycle.

DRY-TYPE DISTRIBUTION
From 15 KVA through 100 KVA, Equipped for Floor or Wall Mounting.



DRY-TYPE
For POWER and LIGHTING From 1 KVA Through 15 KVA 230/460-115/230 Equipped for Wall, Post or Floor Mounting.



SPECIAL APPLICATION
200 KVA, 3 Phase OISC, 2400/4160Y-120/208Y Equipped with OIL Fused Cut-outs, Junction Boxes, etc.

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Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

necessary, old paint can be removed with a caustic solution and a new paint job done from the bare metal up. Moreover, flow-painting protects the customer's premises from scattered paint that results when spray painting is used. This technique is an adaptation of flow-painting which the company has been using for several years on large units.

•

Duties of Utility Repair Shop Head*

Under this official falls responsibility for all machine work, piping, and the repairing and testing of arc lamps, the keeping in stock of an adequate supply of arc lamps and their repair parts, and the inspection for quality of all street light poles, fixtures, etc., for sale. At the principal service station he is required to lubricate and maintain a sump pump and grinder, elevator, motors, operating fans at certain stated locations, cranes in stock and transformer rooms, a motor on a glove washing machine and miscellaneous building repair work which may be called for in detailed instructions applicable to this locality. He acts as superintendent of the buildings at the service station above cited, oversees operation of the heating system and supervises janitor service, besides being responsible for the maintenance and inspection of fire extinguishers in specified buildings of the company, and a monthly inspection of plumbing in the headquarters office.

During the time when no trouble operator is on duty at the principal service station, the repair shop head or his assistant is required to count all city fire alarm signals sounded on a repeater on the shop premises. He also has supervisory responsibilities in connection with snow removal at this station, and answers certain routed telephone calls when the emergency man is absent. The care of the shop machinery is his duty, as is the lubrication and cleaning of specified electrically operated water coolers. On the first of the month these outfits are cleaned and the commutators wiped, the motor bearings being lubricated as needed. This official also repairs new apparatus or ma-

*One of a series of presentations covering the essential duties of officials of a public utility distribution department serving between 50,000 and 75,000 meters. Organization of the distribution department was outlined in ELECTRICAL WORLD, October 13, 1945, page 106.

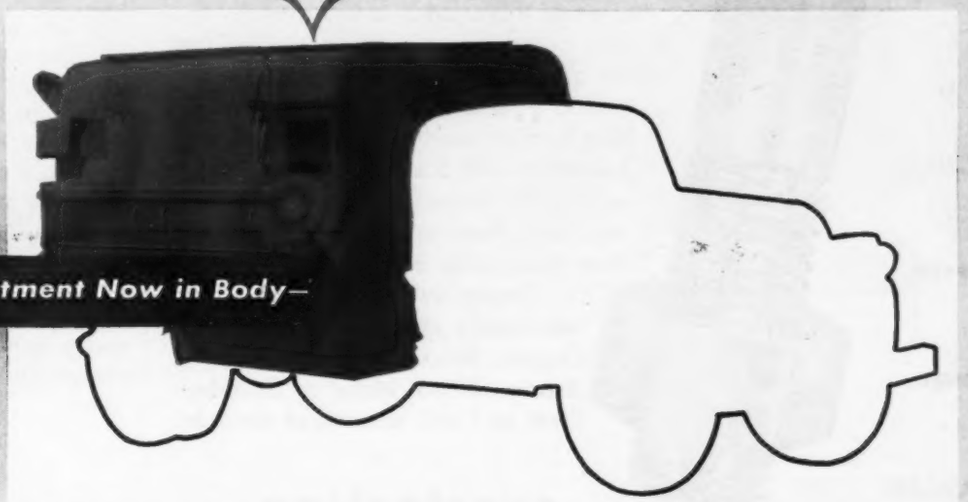
2 IMPORTANT BENEFITS in the RE-DESIGNED *American B 4*

1 You gain two important benefits with the re-designed American B4, the famous all-around utility truck with the many exclusive American features.

The crew has much more room, a full 39" of width, complete visibility, good ventilation and all-around, safe comfort. They arrive on the job ready to go to work.

2 Here's the important dollar story. The crew-in-the-body removes the cab from the special to the standard class. This means ready resale on the open market. An important factor when you consider American bodies outlast a chassis at least 2 to 1 and many times 3 to 1. Now your B4 is more valuable than ever before.

Get the complete profit story on the American B4 in Bulletin B-4, mailed promptly on request, or ask us about it on your next visit to the big modern American factory in Cleveland, Ohio.



Crew Compartment Now in Body—

Improved AMERICAN REVOLVING AERIAL LADDER

New method of counter-balancing makes this ladder so easy to manipulate, a child can do it. Regardless of angle, you can place in position with one hand. 40 spotting positions instead of 20. Turn complete circle in as narrow a body as 46". New type lock assures complete safety at all times.

Available in 3 sizes for any make of chassis . . . when fully extended, platform height to ground is 23' 6" . . . 26' 6" . . . 30' 6". *Saves time and money. Write for details.*

The AMERICAN COACH & BODY COMPANY

9503 Woodland Ave. CLEVELAND. OHIO

ACB and

as the Sea itself!

BRASS

BRONZES

COPPER

MONEL

STAINLESS

Scientists have made many guesses as to how long the seas of the world will last. Some think they will last forever. There is little guessing, however, as to how long Harper non-ferrous and stainless fastenings will last . . they will far outlast the assemblies in which they are used. Even in corrosive chemicals they will outlast common steel because . Harper Everlasting Fastenings are made exclusively of Brass, Copper, Naval Bronze, Silicon Bronze, Monel Metal or Stainless Steel and will not rust or corrode.

everlasting fastenings

A stock of over 5000 different types and sizes of bolts, screws, nuts, washers and other standard items assures fast delivery of your orders. Specials are engineered and produced from raw materials on hand for speedy fabrication. Ask for our 120-page 4-color catalog for easy reference.

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terials received in a defective condition only when such repairs have been approved by the office of the superintendent of distribution. He loans tools only for short periods, to responsible persons, and on records provided. Certain duties in connection with the preparation and handling of appliances fall upon him, in line with defined separate instructions. The stores department notifies him when tools are returned to stock, and he inspects, repairs, sharpens or junks them as the case may be. In general he is held responsible for the proper operating condition of all tools in stock, including the numbering of new tools and renumbering of used tools when requested by their recipient.

Under him also come the inspection of certain purchased materials, assembly of new street lighting equipment and required machine work thereon, and repair of this. On notification by the stores department he inspects, assembles and repairs oil cutouts of a specified make, including ordering replacement parts. On or before January 10 and quarterly he cleans the cooling water filter for certain rectifier sets. He stocks one complete set of bare copper fuse wire used in cutouts in sizes 26 to 16 inclusive, and requests replacements as issued, also keeping on hand an ample supply of filled spools in the repair shop in order to replace an empty spool with one containing the proper size for any employee upon request.

•

Gear Lubricant To Be Kept Clean

The reason for a mysterious but also annoying local epidemic of excessive gear wear was a simple one. The cause for the malady was determined by Westinghouse engineers. Fly ash or other abrasive dust was getting into the lubricating oil. That hard dirt particles in gear lubricant are not good is not a new idea, of course. But it had not been generally appreciated how little abrasive dust—fly ash, ore dust, or even logbark dust—need be present for consequences to be serious. In one case, gears of a turbine-driven induced draft fan were wearing and becoming noisy in a matter of days. Analysis of the lubricating oil indicated a small amount of fly ash. Applying adequate oil filters solved the trouble.

WE make these surveys right along, and they result in a common-sense plan to assure correct application of the right lubricants. Briefly, this is what the Shell Lubrication Engineer will provide:

1. Survey and analysis of the lubrication requirements of your plant engines and machines.

2. Recommendations of proper lubricants, together with specific instructions as to when and how they should be used.

3. Scheduled check-ups for all critical or unusual machinery.

4. Reports (if you want reports) about the performance and economies of recommended lubricants in use in your machines. To the Shell Lubrication Engineer, though, the best report is short and sweet: "All machines continuously in service, well lubricated."

* * *

Right here we ought to warn you that the Shell Lubrication Engineer isn't going to tell you everything you're doing is wrong—he may, in fact, find very little fault with the lubricants and procedure you are now using.

Then, too, he will come to you without a rigid set of rules. Your lubricating procedures are probably based on pretty sound experiences that your own folks have had. Your problem is really one of picking out the weak spots before they become trouble spots . . .

So call the Shell Lubrication Engineer for that survey. If your property is so large that he needs help, he will have it. You are bound to gain, if it is only peace of mind!

There is no obligation on your part.

Call your local Shell Representative, or write Shell Oil Company, Incorporated, 50 W. 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL INDUSTRIAL LUBRICANTS

SHELL

LOAD BUILDING

Commercial
Industrial

Residential
Rural

Puppets Tell Lighting Story in Schools

ROY H. KNOX
Sales Promotion & Advertising Manager, Birmingham (Ala.) Electric Co.

Discarding the lecture-chart method employed in former years, the story of better light, better sight, better grades is dramatically and entertainingly told in the public schools of Birmingham by means of a puppet show put on by the Birmingham Electric Co. Reddy Kilowatt, as the leading character, instructs Mary and Sam, two school children, on how to improve their grades by using the right kind of light while studying. The plot is full of trickery, pathos, and genuine fun as byproducts of Sam's schemes to prevent mother's seeing his bad report card. With Reddy Kilowatt's help, the children and mother are delighted to learn the comfort and convenience of proper lighting. Also, the children learn about diffused light, glare, and correct posture while studying. The ensuing results: better grades and report cards for Mary and Sam.

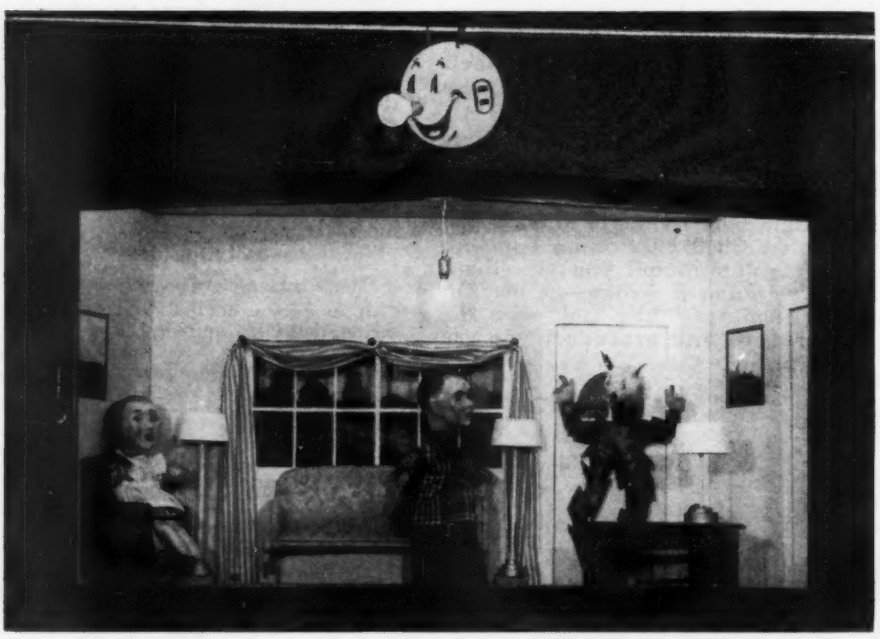
Music for the show is produced by a portable turn-table and amplifier which plays Reddy Kilowatt's theme song at the opening of the show, between curtains, and at the close of the performance. Since all school children know and love the Marine song, a Reddy Kilowatt jingle was devised to fit the tune.

Although the show makes use of four characters, only two people are required to portray them. Two home economists of the company ably work the puppets and assume different voices to suit the characters. In addition to working the puppets and talking for them, the puppeteers deftly work light switches, use a noise maker, blow a whistle, draw curtains, and turn on the music.

When presented to school officials for their approval, the show met with enthusiastic response. Schedules for its appearance were immediately planned for all elementary schools in the City. During the school year, approximately 60,000 school children will learn visually and in an entertaining manner the importance of light in its relationship to eye conservation.

The puppet theatre, which is approximately six feet high and three feet wide, weighs no more than one hundred pounds and is made up of five sections for convenience in transporting it. The ease of setting up and dismantling the stage is further aided by a hinged backdrop with the furniture attached. Although effective stage lighting is used, a drop card with a bare bulb illustrates the wrong kind of lighting for the opening of the play. Later, proper lighting is illustrated with miniature I.E.S. lamps. The whole set fits easily into the back of an automobile which transports it from one school to another.

Beco's puppet show is entirely a company project. The script originated in the sales promotion and advertising department; the stage and scenery were made by the display department; the puppets were dressed by the home economists.



REDDY KILOWATT puppet show dramatizes proper lighting for school children

•

Priority Register for Post-War Appliances

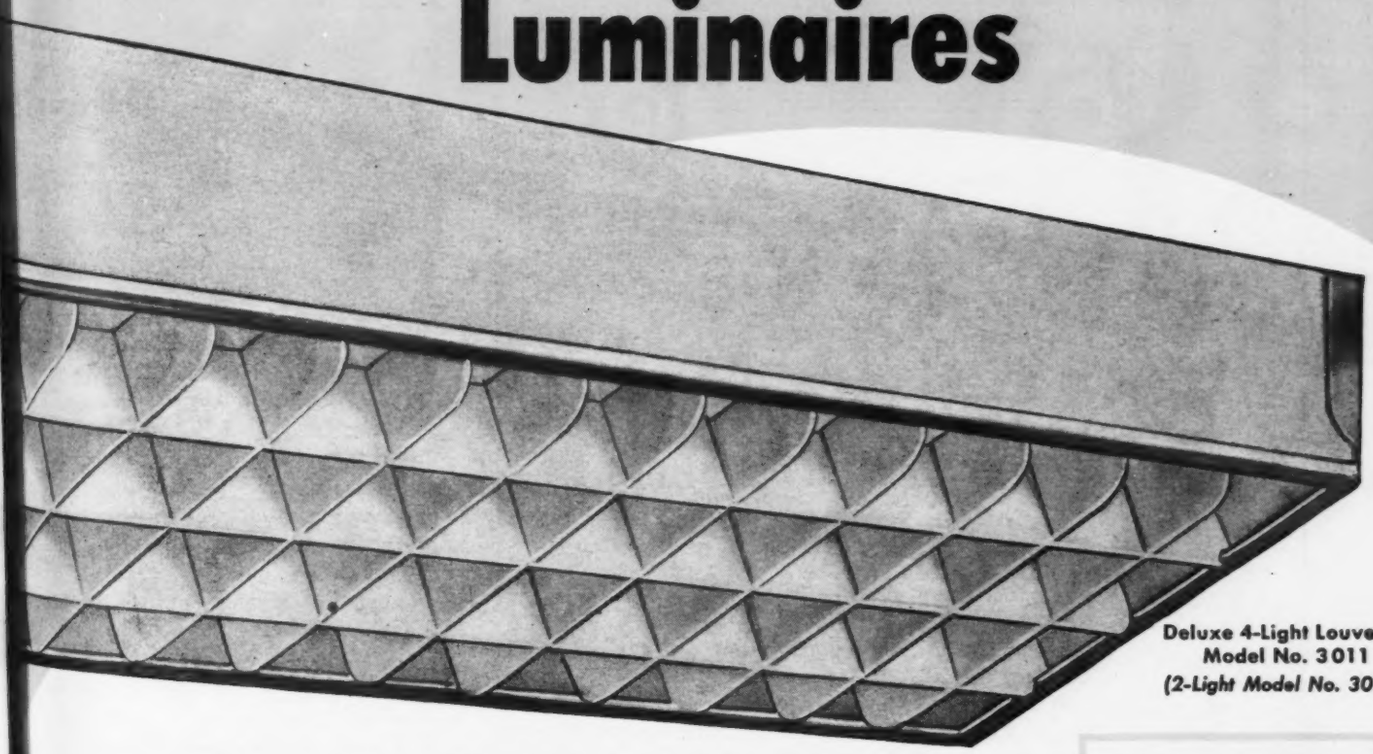
R. G. KNOWLTON
Sales Manager, Concord (N. H.) Electric Co.

A "Priority Register" to give the Concord (N. H.) Electric Co. information concerning the interest of prospective customers in household electric appliances to be available in the post-war market was established in the company's main offices about two years ago, with the result that approximately 2,000 4-in. by 6-in. cards have been turned in by visitors to this establishment. Persons entering the office pass this "Register" on their way to pay electric bills, and take advantage of a writing table accommodating two people at a time in checking appliances in which they are interested. Cards are deposited in a box 5 in. by 10 in. by 7½ in. (deep), the cover being attached to the under side of the table edge and protruding beyond so that a slot in the cover shows. The box itself hangs in a slide which is part of the cover.

Major interest has been shown in refrigerators, washers, ranges, irons and toasters; but in reality cards have been filled out for nearly every type of appliance which the company carries

Lighting Takes Another Step Forward!

NTIRELY NEW AND COMPLETE LINE OF Commercial Fluorescent Luminaires



Deluxe 4-Light Louvered
Model No. 3011
(2-Light Model No. 3009)

Setting a New Standard in Lighting Service!

Offering Exciting New Modern Designs in 2-Light and 4-Light Units . . . Glass-Shielded, Louvered and Open Types • Instant Start • New Patented "One-Man Quick-Mount"!

New opportunities for sales and profits . . . *greater than you've ever known* . . . are open to you now! For MITCHELL ingenuity brings you modern Luminaires to answer every demand for soft, glare-free lighting in stores, offices, schools, public buildings! In this new complete line, you get *a dozen and more vital advantages* that enable you to provide the *finest lighting performance on the market!* Installation is simpler than ever. Maintenance is made easier for servicing economy. Values are exceptional because each unit does a big job for the money.

Add to all this the great record and nation-wide acceptance achieved by MITCHELL products through the years . . . and you have the *strongest selling line today!* Build a big commercial lighting business. Get volume sales and volume profits. Sell MITCHELL Luminaires in 1946!

Get New Catalog No. 285

Use this powerful sales aid. Illustrates and describes complete line of Commercial Luminaires. Includes helpful lighting data, installation and servicing information! Write for it now!

ALL THESE FEATURES!

1. Higher Light Output—Less Glare
2. Scientific Shielding
3. Proper Lamp Spacing
4. True, Full-Depth Louvers
5. Luminous End Plates
6. Instant Start
7. Surface or Suspension Mounting
8. Quick, Easy Installation and Servicing
9. One-Man Quick-Mount
10. Fleur-o-Lier, U.L. and E.T.L. Approved
11. Single Carton Packing
12. Mitchell Guarantee

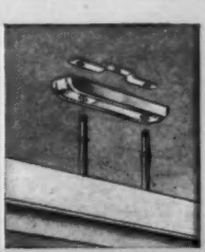
Mitchell Manufacturing Company
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS
West Coast Factory and Sales Office: 1019 N. Madison Ave., Los Angeles 27, Cal.

MITCHELL
FOR TOP LIGHTING VALUE

EASY TO INSTALL AND SERVICE

New, improved heavy-gauge steel wireway channels, with abundant knock-outs for mounting and wiring. Wires, sockets, starters, glass panels, louvers, and other components are readily accessible for replacement, servicing, cleaning.

Units may be surface mounted direct to ceiling, or suspended by Canopy and Stem Set (extra). Models illustrated above may easily be joined end-to-end in continuous rows.



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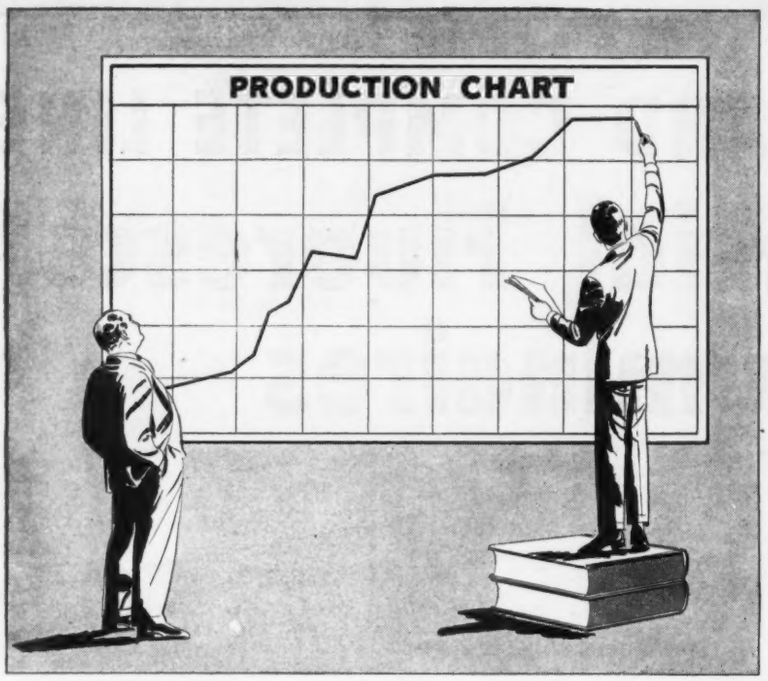
Commercial and Industrial Fluorescent Lighting Equipment • Store Window Lighting • Spotlights and Floodlights • Desk Lamps • Portable Floor and Table Lamps • Bed Lamps • Ultraviolet and Infrared Health Lamps • Residential Lighting Specialties



"Say—WHO THOUGHT OF THIS INFRA-RED IDEA?"

It was Wabash, of course!

Wabash who made infra-red a practicable tool for increasing industrial production—and cutting manufacturing costs.

It was Wabash who developed the special Birdseye tungsten filament that provides uniform distribution of radiant energy . . . at the wave lengths best suited for the purpose.

Wabash who devised the sealed-silver reflector lining that always stays bright—who locks each lamp with the "Superlok" lamp base that even terrific tunnel temperatures cannot loosen.

And it's Wabash who helps you engineer each application, to meet the requirements of *your* job.

So, remember, when you make your plans to profit by the proved advantages of infra-red in speeding up baking, drying and preheating processes—it will pay you to come to the company that is first in the field of infra-red.

WABASH CORPORATION
345 Carroll Street, Brooklyn 31, N. Y.
A Subsidiary of Sylvania Electric Products Inc.

WABASH-BIRDSEYE
FIRST IN INFRA-RED

FIG. 1—Visitor to utility office files card indicating interest (without commitment) in home appliances when available

or plans to sell. As yet the company has not had the opportunity to find out the proportion of definite prospects covered by the card records, but in the case of electric irons, 60 percent of the number of persons notified through this card system that such appliances are available have purchased them. No commitment is involved except an agreement by the company to notify the signer of each card when particular merchandise is available.

•

Tool Steel Super-Cooled In Deepfreeze Units

During the war while the possibilities of quick freezing in the storage of surplus foods have been captivating the imagination of housewives over the country, the industrial counterpart of the home freezer—a mechanical refrigerator capable of developing temperatures of the order of —120 deg. F.—has been imparting greater hardness and wearing properties to tool steel through the application of a new heat-treating technique known as "super-cooling."

This technique, which is being used by such firms as Lindberg Steel Treating Co. and Perfection Tool & Metal Treating Co., Chicago, makes it possible to attain improved cutting properties in high-speed steel and increased hardness in case-hardened steel of

MODERN ALCHEMIST

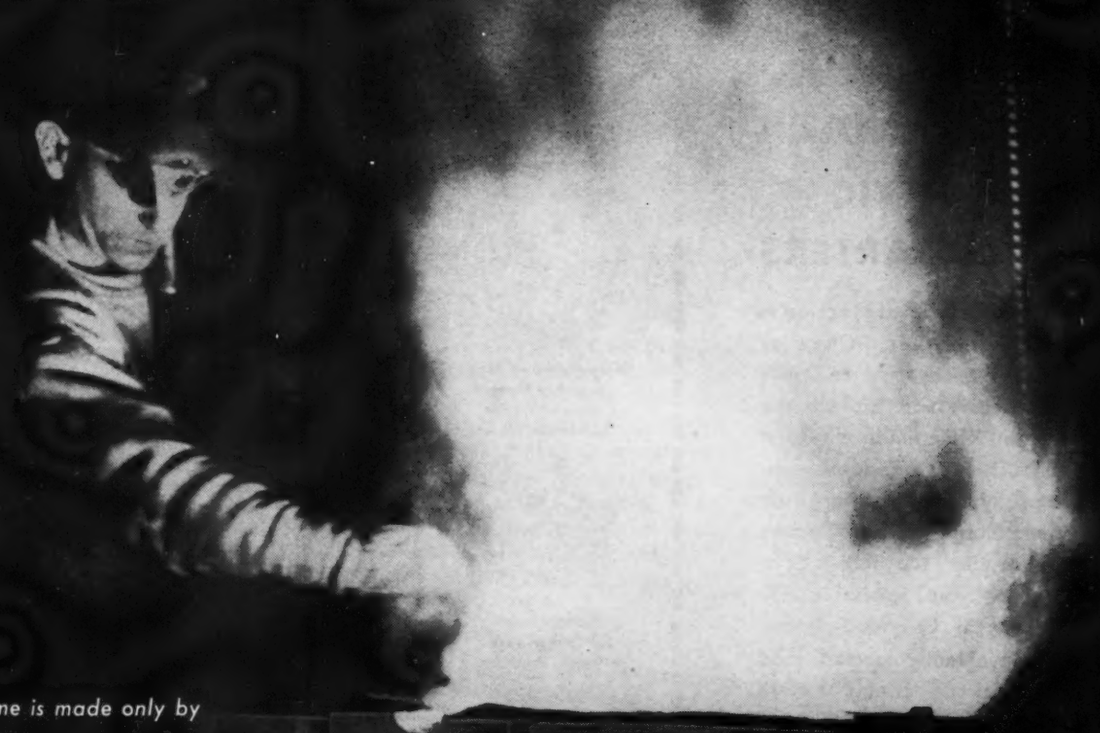
....producing the world's foremost resistance alloy!

Nichrome

Unlike the ancient alchemist who unsuccessfully sought to create gold from base metals, this modern metallurgist is fusing nickel and chromium to produce Nichrome—the world's foremost heat and corrosion resistant alloy!

But it takes more than a balanced union of nickel and chromium to produce the superior properties of genuine Nichrome. For one, there is the all-important factor of exclusive Driver-Harris techniques. In every manufacturing and processing operation, from furnace to spool, exacting metallurgical controls and checks operate to assure the peerless and enduring qualities of Nichrome. These quality controls represent 46 years of continuous alloy research that have established Nichrome as the time-tested standard by which other electrical resistance alloys are measured.

Although there are other excellent nickel and chromium combinations, there *is only one* Nichrome . . . and it is made *only* by Driver-Harris . . . thus Nichrome is at once the registered Trade Mark and symbol of service and belongs wholly and solely to the Driver-Harris Company.



Nichrome is made only by

D/H SPECIAL PURPOSE ALLOYS SINCE 1919

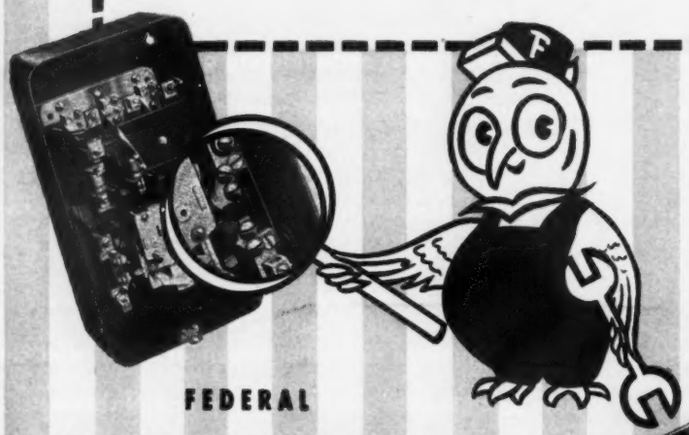
Driver-Harris COMPANY

HARRISON • NEW JERSEY

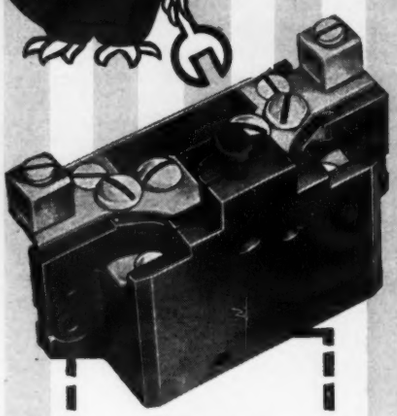
BRANCHES: Chicago • Detroit • Cleveland • Los Angeles • San Francisco • Seattle

Trade Mark Reg. U.S. Pat. Off.

FOR FOOL-PROOF SAFETY EVERY TIME
IN CUTTING MOTORS FROM THE LINE,
THIS FEDERAL RELAY DOES THE TRICK
WITH THOSE WHO KNOW—
IT'S BOUND TO CLICK!



FEDERAL
OVERLOAD RELAYS
STANDARD EQUIPMENT ON

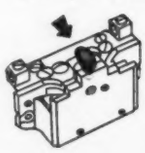


Federal NOARK
MAGNETIC
MOTOR STARTERS

Wherever overload protection is needed . . . whether on new or existing installations . . . Federal's Overload Relays will provide the "plus-margin" of dependability generally associated with Federal products. Naturally, these relays are built into Federal Noark Magnetic Starters . . . but remember, too, that they're available for your special applications. Federal Overload Relays provide conveniently located load and control circuit terminals, often making additional terminal blocks unnecessary.

DESIGNED FOR AUTOMATIC OR MANUAL RESET

Diagram shown above illustrates Plunger (arrow) set for "automatic" reset.



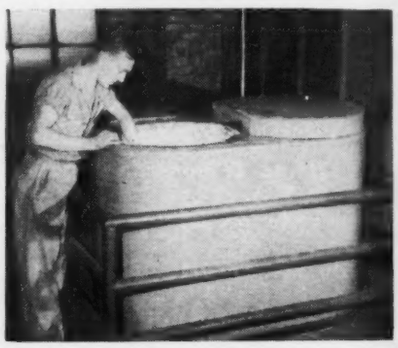
Plunger is set for "hand" reset in above diagram.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. · PLANTS: HARTFORD, CONN. · NEWARK, N. J.

proper analysis, and to stabilize the size of all steels.

Very briefly, super-cooling may be thought of as a method of securing a quicker quench and of carrying the quench down below room temperature into the sub-zero region where, as temperature goes lower and lower, more and more Austenite is transformed into Martensite, a stable, hard and wear-resisting granular structure that imparts its desirable properties to the steel.

All alloys do not require the same minimum temperature for transformation. Investigations have proved that the range of from —80 to —120 deg. F. will promote transformation in most

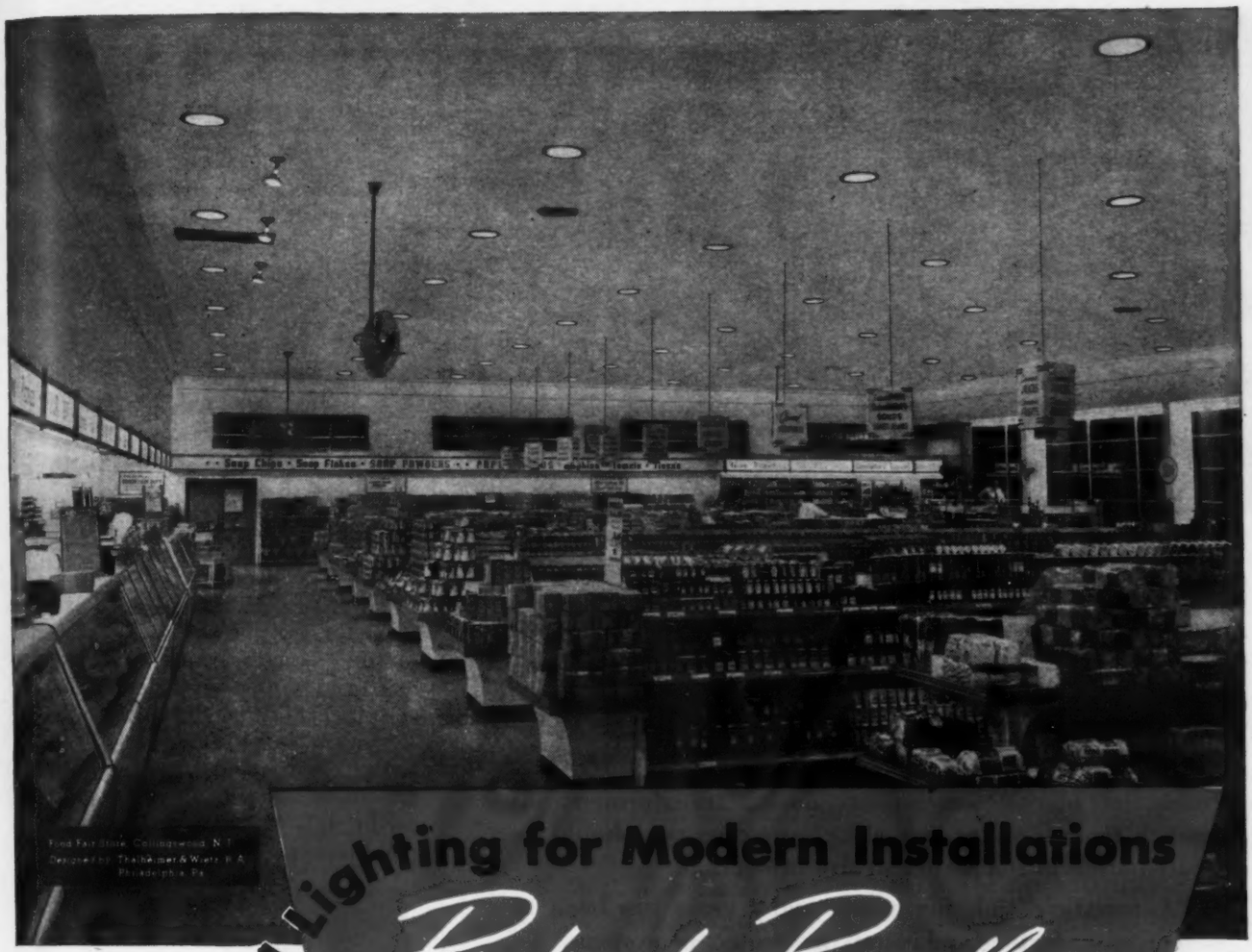


DUPLEX CHAMBERS in this super-cooling unit can be operated simultaneously or alternately as desired. Temperature of each can be adjusted at will. For most work they are operated at —120 deg. F. continuously

of the tool steels and other alloyed steels used today.

For many years it was difficult to secure temperatures low enough to promote sufficient transformation of Austenite to be effective. This limitation delayed investigation of the effect of low temperatures on alloy steels. Within the past five years, however, super-cooling has been rendered entirely practical as a mass production heat-treating operation by the development of mechanical refrigerators capable of developing temperatures low enough to transform up to 95 percent of the Austenite remaining after a conventional quench.

Proof that the super-cooling does bring longer tool life is to be found in service records showing anywhere from 25 to 300 percent improvement in the number of pieces cut per grind of tool. Steel wool cutters, for example, which required grinding every four hours with conventional heat treatment, when subjected to sub-zero transformation during the heat-treating cycle had their life increased to



Engineered Lighting for Modern Installations

Pittsburgh Permaflector LIGHTING EQUIPMENT

Illustrated above is an outstanding supermarket interior in which *Pittsburgh Permaflector* Incandescent and Fluorescent Equipment is used to achieve efficient illumination and a sales-stimulating overall effect. In this, and thousands of other commercial, industrial and institutional applications, *Pittsburgh Permaflector* Equipment provides the ideal answer to ALL lighting needs.

Designed to be flexible and functional, engineered to be efficient and practical . . . *Pittsburgh Permaflectors* combine ease of installation and maintenance with maximum illuminating efficiency.

For your next lighting requirements—whether for modernizing or new building—PLAN your lighting layout around *Pittsburgh Permaflector* Incandescent and Fluorescent Lighting Equipment. You will find: "There's a *Permaflector* for Every Purpose!" Consult your nearest *Pittsburgh* Lighting Engineer—or write direct. We will gladly help you put PLANNED PERMAFLECTOR LIGHTING to work for you.

"Pittsburgh" Permaflector

Pittsburgh Reflector Company

OLIVER BUILDING · PITTSBURGH 22, PA.

MANUFACTURERS OF PERMAFLECTOR LIGHTING EQUIPMENT
DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

Permaflector Lighting Engineers in all Principal Cities

Industrial plants, warehouses, docks, transformers, oil quench tanks—no two are alike, hence no two should be treated alike in the matter of fire protection.

"Automatic's" job for many, many years has been to design, manufacture and install fire protection systems. We know that what is adequate in one instance may not be suitable in another. Fire protection in a cold storage plant, for example, would be wholly inadequate for a powder manufacturer.

Right there is where the knowledge and skill of "Automatic's" engineers is of inestimable value. Drawing from a wealth of experience, they recommend only that fire protection system which is *best-by-test for any given purpose or condition.*

Today's executives, entering upon an era of peace-time effort, know the wisdom of safeguarding lives and property . . . which explains why so many are writing "Automatic" for detailed information on fire protection. Why don't you?

—a famous member of the "Automatic" Sprinkler Family. Provides adequate protection for quench tank, transformer, oil line and other fires of flammable liquid origin.

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

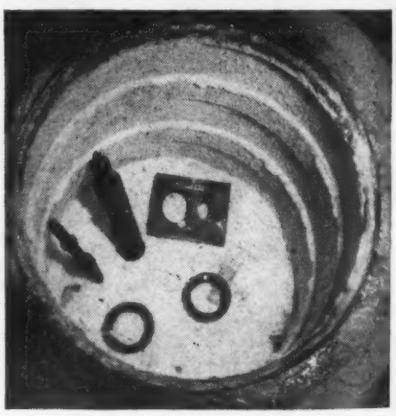
YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

eight hours before grinding was required.

Super-cooling has also been used to stabilize the dimensional properties of gages and machine parts where "growth" of the part with age would be harmful. The transformation from Austenite to Martensite at room temperature takes years to complete and it is accompanied by a change in the size of the piece. Martensite occupies more volume than Austenite. Because of this gradual growth it has been the practice, in the past, to "age" very accurate gages for a period of one or two years. Now, however, with super-cooling, the gage or machine part can be lowered in temperature to the point where transformation to Martensite, hence size stabilization, takes place in hours or days instead of years.

Both the Lindberg Steel Treating Co. and Perfection Tool & Metal Treating Co., specialists in the treatment of metals, use double-chamber Deep-freeze units for the routine application of super-cooling to treating cycles. Units employed are capable of withdrawing heat at the rate of 4,000 B.t.u. per hr. at —120 deg. F. Units of this type have two cold chambers which



SUPER-REFRIGERATORS cool tool steel to —120 deg. during heat-treating cycle

can be operated either simultaneously or alternately and at independently adjustable temperatures. In practically all instances, however, the chambers are held at —120 deg. constantly.

The refrigeration equipment that cools these chambers employs two compressors. One compressor and evaporating coil is used exclusively to cool the gaseous refrigerant (to —50 deg. F.) before it enters the second compressor. Evaporating coil of the second compressor reduces the temperature of the super-cooling chambers. Both compressors are powered by individual 2-hp., 220-volt motors.

FROM EXACT PROPERTIES TO FINISHED PARTS

PANELYTE

can be FABRICATED to your order

PROPERTIES

PANELYTE properties are listed below—not as descriptive of any one grade of these paper, fabric, fibre glass, and asbestos base thermo-setting plastics—but to show the range of properties of the 32 grades.

HIGH DIELECTRIC STRENGTH

Volts/Mil. Short Time Test, ⅛" Thickness—up to 700 volts.
Dielectric Constant, at Radio Frequency (1 megacycle from 6 to 5 for electrical controlled grades)
Power Factor, at Radio Frequency (1 megacycle from 6.5% to 2.5% for electrical grades)

UNUSUAL STRUCTURAL STRENGTH

Izod Impact Strength (ft. lbs. per inch of notch)—0.5 to 20.
Compressive Strength (psi)—20,000 to 55,000.
Tensile Strength (psi)—7,000 to 35,000
Modulus of elasticity in tension (psi x 10^5)—7 to 30.
Flexural Strength (psi)—12,000 to 40,000.

EASY MACHINABILITY

May be Sawed, Die Punched, Drilled, Lathe Turned, Milled, Knurled, Grooved, or Shaved.

LIGHT WEIGHT

20 Cubic Inches Per Pound—Half Weight of Aluminum.

LOW WATER ABSORPTION

As low as 0.7% in 24 hrs. immersion.

CORROSION RESISTANT

Not affected by Water, Brine, Oil, Ordinary Solvents, Coolants, Ketones, Esters, Most Acids and Weak Alkalies.

LOW COEFFICIENT OF FRICTION

LOW THERMAL CONDUCTIVITY

GOOD DIMENSIONAL STABILITY

Low Cold Flow—Uniform Thermal Expansion—Does Not Warp Under Normal Conditions.

EXCELLENT HEAT RESISTANCE

Heat Resistance—300° F. for cellulosic base; inorganic base materials are flame resistant.—Does Not Soften Under Heat.—Only Effect of Hot Water to Accelerate Absorption.

Two examples of Panelyte *precision* fabrication are shown above. Panelyte laminated plastic, Grade 942, was selected for the ball-bearing retainer ring, 2 15/16" O.D., because of its high dimensional stability.

The enlarged Panelyte Fabricating Plant (most modern in the industry) is equipped to turn out similarly accurately machined parts . . . lathe-turned, drilled, reamed, and undercut . . . for you. Or intricate radio parts such as the one shown of Panelyte Grade 550, requiring three turret lathe operations in addition to milling, drilling and tapping.

Panelyte Sales Engineers are ready to cooperate with your Engineering Dept., give designing aid, and from performance data on hand, make accurate estimates on the service life of proposed applications.

Inquiries are invited on sheets, rods, tubes, and *molded* as well as fabricated parts. Write for factual "Engineering Data Book".

PANELYTE *the structural plastic*

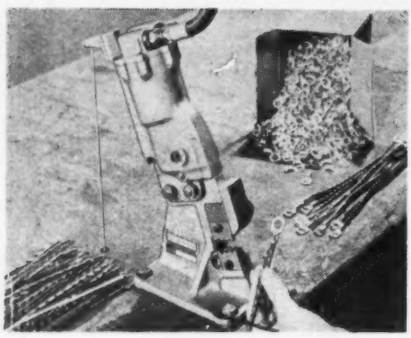
PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Nashville, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Trenton: Buenos Aires, Johannesburg, Mexico City, Montreal, San Jose, Sao Paulo, Sydney, Toronto, Vancouver.

★ **MASS PRODUCTION OF SHEETS, RODS, TUBES; MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, ASBESTOS BASE LAMINATES; DECORATIVE GRADES**

NEW EQUIPMENT

Tool

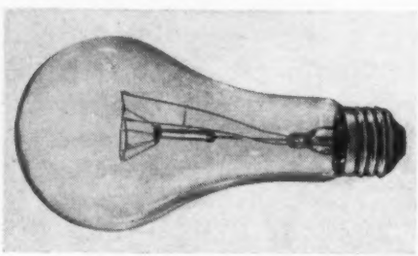


Type "No. YIONCP" pneumatic tool for installing connectors: for use with connectors No. 18, 14 and 10 on wire sizes from No. 22 to 10. **Burndy Engineering Co., Inc.**, 107 Bruckner Blvd., New York 54, N. Y.

A bench-mounted, pneumatic tool, which makes the connection between the connector and the cable with a single controlled stroke, has the die tilted at a slight angle to facilitate operators' work. The tool is said to make high-speed production possible throughout its wire size range.

•

Incandescent Lamps



Lamps for vibration service: 115, 120 and 125 volt service; 50 and 100 watt. **Sylvania Electric Products Co.**, 60 Boston St., Salem, Mass.

Lamps are designed for marine, power plant and industrial equipment service where there is a constant jar and vibration from heavy or high-speed equipment. Bulb types include clear and inside frosted and are designed for vertical burning.

•

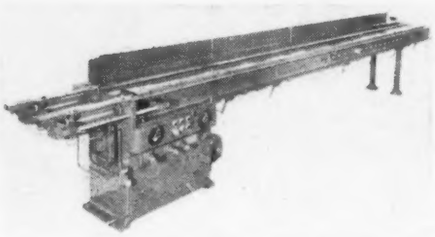
Contactor

Type "135CXX" reversing contactor: wt, 2½ lb. size 5 3/4x4x1 7/8 in.; for use on circuits up to 600 v.a.c. **Struthers-Dunn, Inc.**, 1321 Arch St., Philadelphia 7, Pa.

Reversing contactor is designed for use with polyphase motors up to 1 hp., single-phase motors up to ¾ hp. and is made for use on circuit potentials from 110 to 600 volts a.c. It consists of two 3-pole contactors mechanically interlocked and has a one-piece solid frame structure. It is reported as suitable for control operation on small hoists, door and window opening devices, machine tool cross feeds and other applications requiring reversing service.

•

Tester



Tensile strength tester: bed is 25 ft. long, accommodates cables up to 20 ft. in length; test loads up to 15 tons. **John S. Barnes Corp.**, Rockford, Ill.

Machine was developed to determine tensile strength or modulus of elasticity of wire, cable, etc. Report states that an inexperienced operator can perform the tests quickly and safely without resorting to laboratory methods. Elongation of material under test is registered automatically on the verniers on the machine front. Verniers may be reset to zero at any time during the test so that comparative readings may be obtained for portions of the test cycle.

•

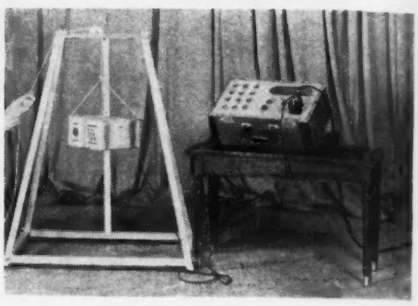
Resistor

Type "RN" resistor: operates in temperatures up to 275 deg. C. **P. R. Mallory & Co., Inc.**, Indianapolis, Ind.

Vitreous enamel tab-type unit which is reported to meet joint AN Grade 1 Class 1 specifications is said to withstand thermal shock from 275 deg. C. to 0 deg. C. and to operate in temperatures up to 275 deg. C. Units are reported to withstand momentary overloads up to ten times rated wattage.

•

Cushioning Meter



Cushioning meter for measuring packing efficiency: covers range from 10 to 100 G's; operates on 110-volt, 50/60 cycle power supply. **General Electric Co.**, Schenectady 5, N. Y.

Unit consists of a detector head and an indicator. The head contains an electric mechanism which responds in varying degrees to the shock it experiences. This response is transmitted through a flexible cable to the indicator, on which it is registered by the energizing of neon glow lamps marked to correspond to the peak shock expressed in G's. The lamps continue to glow until the reset button is pressed.

•

Light Source

Microflash for photographic exposures: dissipates energy in 2 microseconds; dimensions, 24⅛ x 13¾ x 11¾ in.; wt. 72 lb. **General Radio Co.**, Cambridge, Mass.

Unit consists of a power supply, which charges a condenser to a high voltage, and a means for discharging the condenser through a special gas-filled lamp, designed to dissipate most of the energy in about 2 microseconds. The flash may be initiated by a make or break contact, by an electrical impulse, or by sound from the microphone. The lamp and power supply are mounted in separate metal cases which lock together in a single unit for transportation.

•

Heat Ray Lamp

R-40 heat ray lamp with splatter-proof bulb: 250 watt. **Westinghouse Electric Corp.**, Lamp Division, Bloomfield, N. J.

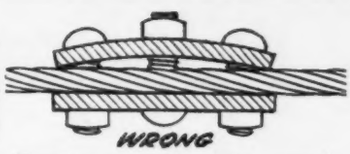
Lamp has a red heat-resisting glass bulb which is resistant to breakage when subjected to the shock of cold water spray. It is recommended as a heat source for drying

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

WHY?

DO HUBBARD STRAIGHT GROOVE GUY CLAMPS HOLD BEST?

1. **Because:** The **straight groove** eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand.



Clamping area reduced by warped section. Causes slippage at low strains.

Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

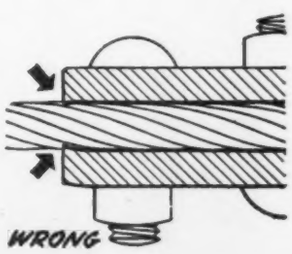
2. **Because:** The **straight groove** fits any and all twists, right or left hand and a variation in diameter without **creating** any high spots to **lessen clamping area.**

High spots in clamp reduce clamping area, cause slippage and injure strands.

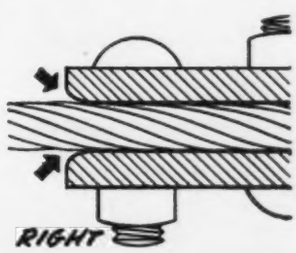
Hubbard Clamps fit snugly over any and all twists, right or left and variations of diameter.

3. **Because:** Bell-end grooves prevent injury to the strand.

4. **Because:** High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used — HUBBARD DOUBLE-DIP HOT GALVANIZING.



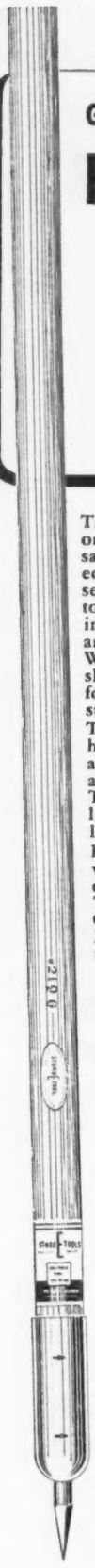
Sharp edge from sheared section injures and weakens the guy at end of clamp



Rounded ends of Hubbard Clamp sections protect strand.

HUBBARD and COMPANY

Pittsburgh Oakland, Calif. Chicago



Give your crews the

Protection

of this

STURDE

Guarded

Pike Pole

The patented, automatic shield on this SturdE pike pole is a safety feature for your men—an economy feature for you. The seamless steel tube slides down to protect the point when not in use, guards it against damage and prevents accidents to crews. When action starts, the guard slides back, and *locks* to reinforce the ferrule and give added strength.

The 8⅛ in. spike is forged from high grade steel, heat treated and tempered for hard service, and can be easily repointed. The fir handles are sanded and lacquered, and come in five lengths, 12 to 20 feet.

Here's a sturdy, long-life tool with a safety feature that adds extra value. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio, Makers of True Temper Products.

STURDETOOLS

a **TRUE TEMPER** **PRODUCT**

Exclusive SturdE feature — Automatically released tubular shield is easy to operate, locks into place and reinforces head when pole is in use. Slips down to protect point for carrying and storing.

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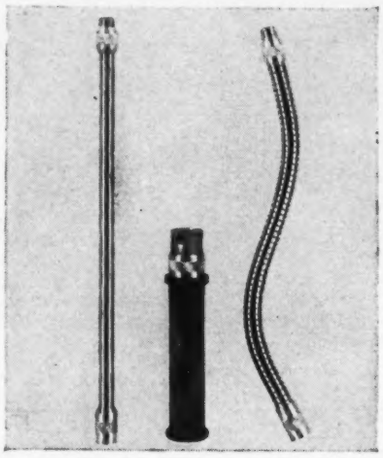
laundered articles and for other drying applications where water or liquid may splatter on the hot glass bulb.

•

Probe Magnets

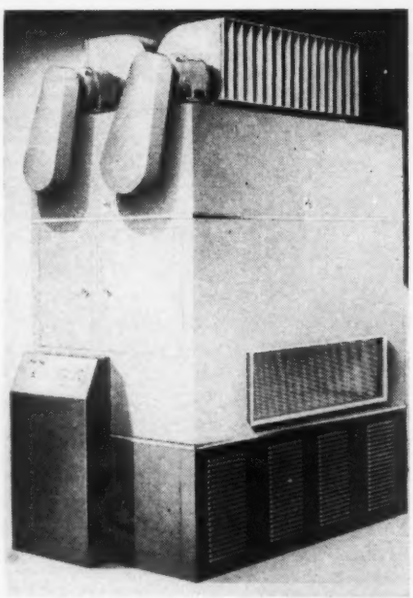


Flexible probe type permanent magnets. **George W. Hamilton Associates**, Evans Building, Washington, D. C.

Unit is designed to probe for, and extract from inaccessible locations, magnetic materials such as screws, bolts, and nuts. All connections are made with standard threads, which allow for complete interchangeability. The rigid extension may be used with or without the flexible extension or the magnet may be affixed to the handle for short probing distances. Finish on extensions is cadmium plate. Magnets are reported as having long life and can be remagnetized when necessary.

•

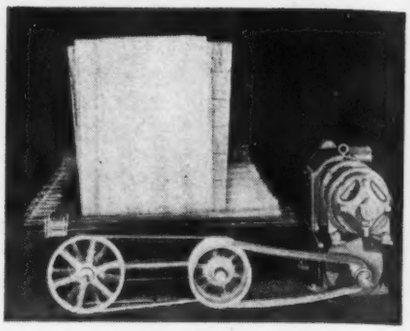
Air Conditioning Unit



"Airtopia," air conditioning unit: smallest size, 3½x5x7 ft. for use in 7-room house. **Drayer & Hanson, Inc.**, 767 E. Pico Blvd., Los Angeles 21, Calif.

Units are made in various sizes for use in homes, office buildings, laboratories, stores, institutions and individual offices. The unit is reported to keep temperatures constant (alternating between heating and cooling), to control humidity and to cleanse air.

Vibration Tester

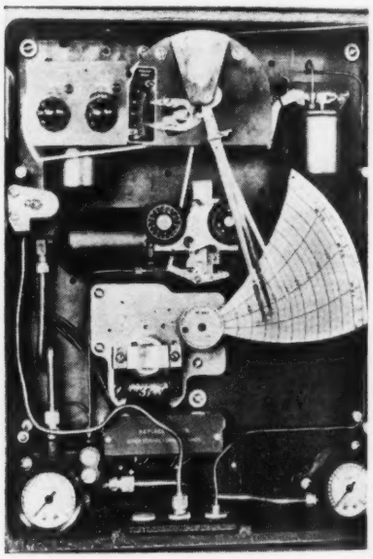


Vibrating test table: table size 5x5 ft.; capacity 1,000 lb. **L.A.B. Corp.**, Summit, N. J.

Unit was developed to run vibration tests on equipment and packages. It has two eccentric shafts, one under each end of the table, which cause a circular motion in a vertical plane. The shafts may be run in synchronism or out of step to provide various degrees of vibration.

•

Industrial Instrument



"Adjustable Indexet," instrument for adding, subtracting, multiplying and dividing. **Brown Instrument Co.**, Philadelphia, Pa.

Instrument is essentially a pneumatic receiver with two new mechanisms added, consisting of a "span" and "zero" shift. The span or proportional adjustment permits a change between the span through which the instrument control point is moved and the change is transmission pressure which moves the control point. Span dial is calibrated in terms of the distance in percent of full scale that the control index will move per full scale changes in pressure. Span is the multiplying and dividing adjustment. The zero, or linear, adjustment adds or subtracts a constant value. It is calibrated in terms of full scale and moves the zero position along the chart.

•

Inspection Light

"Eder-Lite," an inspection light set. **Harmon & Co.**, 6 N. Michigan Ave., Chicago 2, Ill.

Set consists of a built-in push button type transformer lamp handle constructed for a.c. use, a 10-ft. plug-in cord, two rigid and two flexible extensions of varying length which

NEW PROBLEMS?

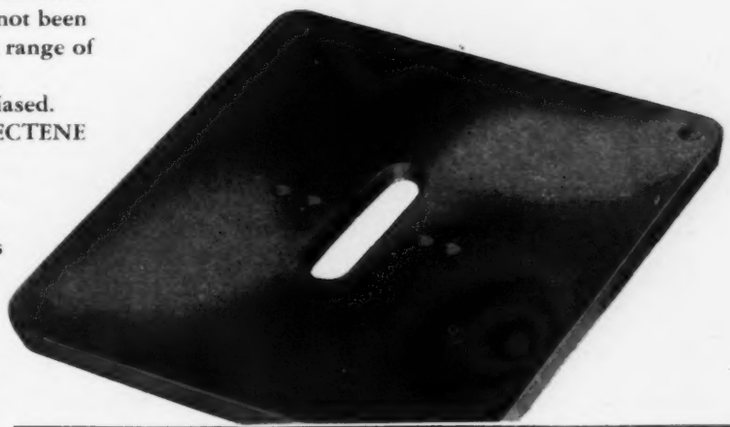
C-D *has acquired the* KNOW-HOW *to help you apply* DIELECTRICS

You will save time and worry . . . and avoid costly errors, by having C-D technicians help you select the appropriate material to meet your particular electrical insulating problem. They will also help you determine its most economical and efficient form to meet your design and performance requirements.

C-D technicians have helped thousands of manufacturers solve "What Material?" problems. The KNOW-HOW which they have acquired in solving such problems will enable them to help you. Their experience has not been limited to one or two Dielectrics, but to a wide range of products as shown in the C-D products listing. Their recommendations will, therefore, be unbiased.

The part illustrated herewith is made of DILECTENE —a pure resin product having extremely high and stable electrical insulating properties, even under abnormal moisture conditions. DILECTENE was developed by C-D technicians to provide an electrical insulating material that would meet the high standards and exacting requirements of U-H-F equipment.

Consult with C-D technicians while your designs are in the blue print stage. Make sure you are using the right electrical insulation in its best form . . . before your products go into production. Wire, phone or write the nearest C-D office and C-D technicians will get on the job.



C-D PRODUCTS

The Plastics

DILECTO—Thermosetting Laminates.

CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

RBC-46

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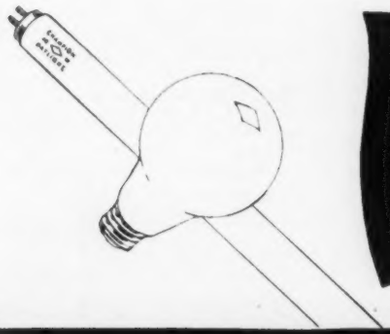
Established 1895..Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

WHEN YOU BUY
CHAMPION *Lamps*
HERE'S HOW MUCH MORE
YOU GET FOR YOUR MONEY

1 **Champion Quality**—the result of forty-six years of concentration on the manufacture of lamps for industrial service. Champion **Fluorescent** and ***Incandescent*** Lamps are guaranteed to *equal or exceed* Federal Specifications and backed by the production and quality control resources of one of the largest lamp producers in the industry.

2 **Champion Economy**—the entire Champion manufacturing and distributing set-up is devoted to the job of getting lamps to you at minimum cost. When you standardize on Champion Lamps you can be certain of getting the most lighting and lamps for your money.

3 **Champion Service**—trained lighting experts in the field to help you on every lighting problem, and a carefully selected industrial distributor near your plant, ready and able to provide prompt, intelligent and economical attention to your lamp needs on the spot.



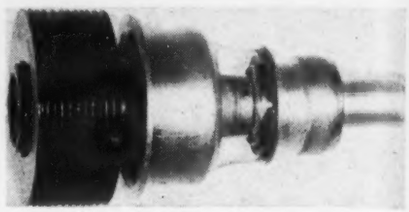
Try Champion Lamps and find out for yourself how much these extra advantages mean to you. Let us give you the name of nearest Champion industrial distributor.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

can be used in combination or separately, and four screw-in miniature tungsten bulbs of varying sizes. The lights and extensions were developed to inspect hard to get at places through openings as small as ¾ in. in diameter.

•

Tube



Type "3x100A11/2C39" transmitting tube; height, 2¾ in. and diameter, 1¼ in. **Eitel-McCullough, Inc.**, San Bruno, Calif.

Tube is a miniature external anode triode, of the "lighthouse" variety, for use in applications requiring up to 25 watts of power at frequencies above 500 megacycles. It is designed for fixed or mobile equipment and has an indirectly heated cathode with a 6.3 volt heater.

•

Street Light Control

Electronic "Sun Switch:" directional control. **Ripley Co.**, Torrington, Conn.

Control consists of a photoelectric cell, amplifier tubes and a relay housed in a gray aluminum case. The operating unit is built on a chassis to which the housing is attached by three screws. This housing with the chassis is fastened to the permanently wired base with a 30 degree rotary turn which provides the electrical connection and, the report continues, a weatherproof joint. The swivel bracket and the round shape of the housing is said to permit facing the photocell toward the north light without interfering with installation symmetry. The unit is adaptable to controlling lights on highways, buildings, and billboards and at airports.

NEWS ABOUT PEOPLE

Ohio Brass Co. Promotes C. K. King and G. L. Draffan

Charles K. King, who has served as president of the Ohio Brass Co. since 1928, has been elected to the newly created position of chairman of the board. He was also chosen as chairman of the executive committee.

C. K. King

G. L. Draffan

Succeeding Mr. King as president is George L. Draffan who has been executive vice-president since 1938.

K. V. Farmer, who for the past 15 years has been manager of the Canadian Ohio Brass Co., a wholly owned subsidiary, has been made a vice-president of the Canadian concern.

Other officers of Ohio Brass are H. S. Black, senior vice-president; L. W. Olson, vice-president; J. M. Strickler, vice-president; W. A. Springer, secretary and treasurer. R. B. Black, a director since 1930, was appointed to the executive committee.

For the past 53 years, Mr. King has had an active part in operating and controlling the company. His first position in 1893 was that of manager of the Electric Railway Department.

Mr. Draffan came to Ohio Brass in 1916 as assistant advertising manager. Before becoming executive vice-president, he held in turn the positions of general sales manager, and company secretary and director of sales.

•

▶ JOHN D. WADDELL recently became associated with the Delaware Power & Light Co. as assistant operating manager—electric. Mr. Waddell goes to the Delaware utility direct from active duty as a lieutenant commander in the U. S. Naval Reserve. His electrical background is varied in that he has been employed in the past by the Louisville & Nashville R. R. Co., the Jones & Laughlin Steel Corp., and as a licensed electrical contractor. Prior to entering the Navy in 1942, Mr. Waddell had been associated with the Duquesne Light Co., Pittsburgh, Pa., for more than eight years as electrical engineer in the distribution department.

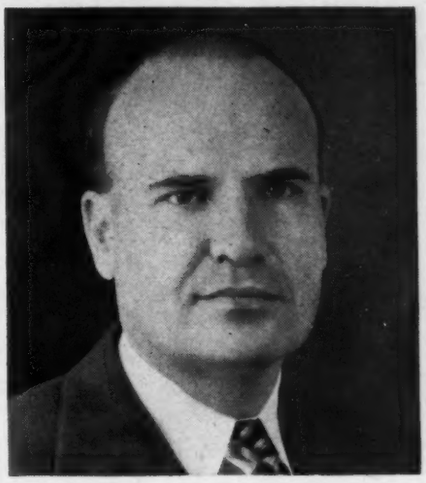
▶ PAUL SMICK, Huntley, Mont., has been named manager of the Idaho County Light & Power Cooperative Association, Inc., Grangeville, Idaho, succeeding EGBERT KABAT, resigned.

▶ CHARLES E. RODEN has returned to Southwestern Gas & Electric Co., Shreveport, La., after serving for five years in the United States Army. Floor sales manager in the Shreveport division merchandising department before entering the service, Mr. Roden has been appointed residential sales manager.

M. H. Pratt Made Chief Engineer of N. Y. Utility

M. H. Pratt has been appointed chief engineer of the Central New York Power Corp., Syracuse, N. Y., succeeding the late Albert W. Andrews.

Following graduation from the University of Pennsylvania, Mr. Pratt started in the subway department of the Syracuse Lighting Co., Inc., and successively served as assistant to the distribution engineer and assistant engineer of the electrical department. In 1929 he was made engineer of the electrical department.



M. H. Pratt

When the Syracuse company joined the Niagara Hudson Power System, Mr. Pratt was appointed assistant to the engineer for the central division of the system. In 1937 when companies in this division merged to form Central New York Power, Mr. Pratt was appointed electrical engineer for the corporation. He also served as assistant to Mr. Andrews.

As chief engineer, Mr. Pratt will direct a department which is responsible for the design of electric and gas systems, for various special studies and research, establishment of construction standards, engineering records and budgets, and the application of new methods to production and distribution of electric power and gas.

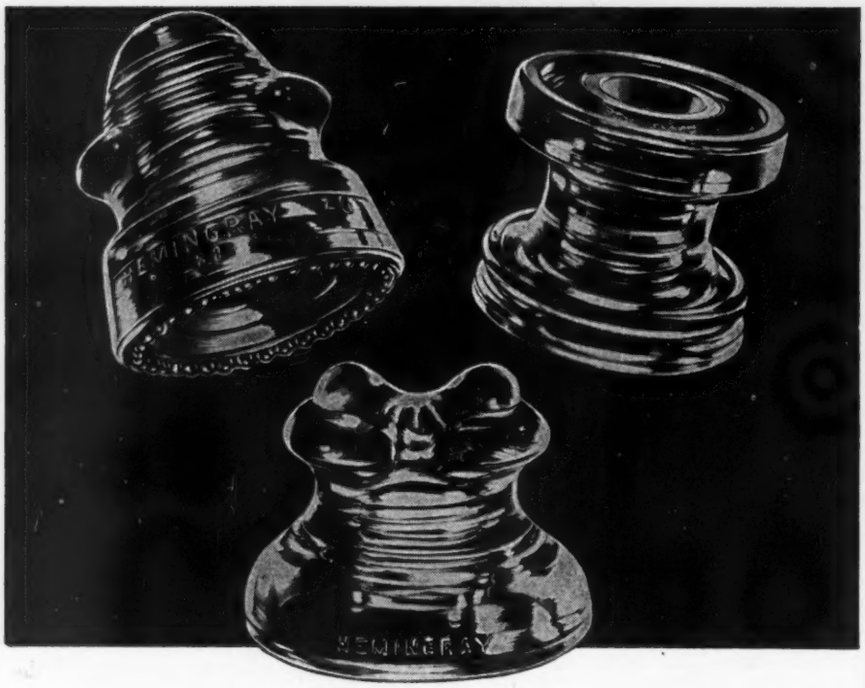
Mr. Pratt is a member of the American Institute of Electrical Engineers.

•

▶ R. BLY WAGNER, for 20 years manager of the Pine Bluff division of the Arkansas Power & Light Co., has been made manager of the Little Rock division, assuming part of the duties formerly performed by R. E. Ritchie, vice-president, who is now working jointly with Vice-President H. F. Minnis in directing the company's $20,000,000 expansion program. W. H. OVERBY JR., manager of the southeast

HEMINGRAY INSULATORS

Favorably Known Since 1870



Power Insulators You Can Rely On!

Hemingray Insulators are made as you would like to have them made. Under exacting laboratory control!

Every batch of glass—every lot of moulded insulators is checked *hourly,* with various precision instruments.

That's why Hemingray Insulators are so free from flaws, so uniform in quality, so dependable.

There are ten Hemingrays for Primary Power distribution for voltages from 2,300 to 15,000 and manufactured in accordance with suggested specifications of the Edison Electric Institute.

There are ten Hemingrays for Secondary Power distribution with heights ranging from 2 15/16 to 5 1/32 inches and diameters from 2¼ to 3¼ inches.

Investigate! Hemingrays are sold by principal jobbers and are manufactured by Owens-Illinois, Hemingray Division, Muncie, Ind.

OWENS-ILLINOIS

HEMINGRAY INSULATORS

Telephone-Telegraph

Export Agents: International Standard Electric Corporation, New York City

division at McGehee, has been promoted to manager of the Pine Bluff division, succeeding Mr. Wagner.

•

Harry Ferguson Advanced by Pennsylvania P. & L. Co.

Harry Ferguson has been appointed operating manager of the Pennsylvania Power & Light Co. For a number of years he had been assistant to the late N. G. Reinicker, vice-president and general manager.

H. Ferguson

In his new position, Mr. Ferguson will have charge of the company's plant betterment department; the generation department, which operates 17 steam and a number of hydro stations; the system operating department; the test department, and a number of others.

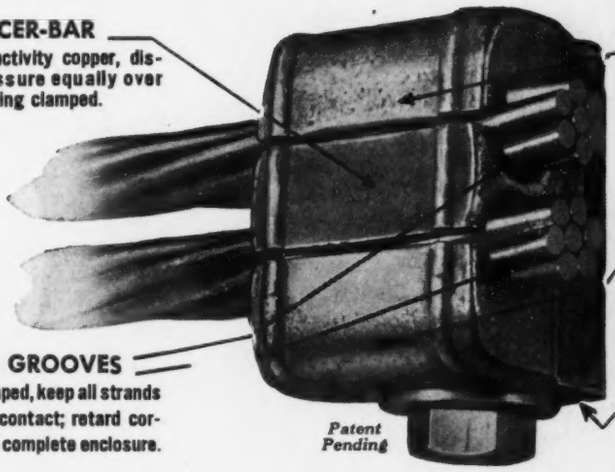
Mr. Ferguson joined P.P. & L. in 1920 as technical engineer of power plants. Prior to that he was employed by the Hope Natural Gas Co. and the New Jersey Zinc Co.

He was born in New Cumberland, W. Va., and was graduated from the University of West Virginia in 1916 as a mechanical engineer. He has just completed a two-year term as chairman of the General Section, Pennsylvania Electric Association.

•

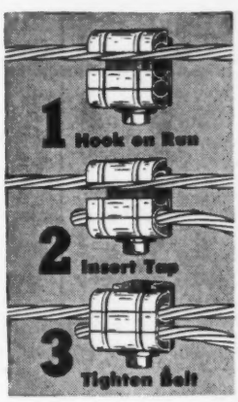
▶ E. W. FLORENCE, who has been manager of the Sacramento, Calif., division of the Pacific Gas & Electric Co. for 25 years, retired January 1, ending more than 45 years of service with that company and its affiliates. Mr. Florence began his electrical career in 1901 at Chico, Calif., where he became branch manager, and was later transferred to Fresno in 1909 and to San Mateo in 1911. He assumed the position as division manager at Sacramento in 1921. L. J. BRUNDIGE, former Chico division manager, will replace Mr. Florence in the Sacramento division, while W. R. BOWLER, sales manager at Sacramento, will fill Mr. Brun-

New HEAVY-DUTY Connector


SPACER-BAR
of high conductivity copper, distributes pressure equally over conductors being clamped.
WIDER JAWS
provide greater area of contact; dispel heat; lessen fatigue and "relaxation" by reducing stresses on the conductor.
FITTED GROOVES
conductor-shaped, keep all strands electrically in contact; retard corrosion by more complete enclosure.
Patent Pending
VISE-TYPE body construction develops inside thrust pressure; assures a vibration-proof connection.

FARGO 7000 HEAVY-DUTY Spacer-Bar Model for HEAVY LOADS

CONSTANT PRESSURE: The Spacer-Bar between the conductors helps distribute pressure equally around the entire periphery of each conductor being clamped. This relieves high stress at the point where the strands of the two conductors are in contact in an ordinary connector, thus eliminating distortion of cable and minimizing "relaxation," *(sometimes noticeable in large-sized conductors after extreme temperature and current load changes)* which would cause loss of pressure.



Easy to use

BETTER CONTACT: The round inside diameter of jaws and bar increases the total area of contact with the conductor. The increased width of the 7000 Series also insures better electrical contact between all strands of the conductor . . . a particular advantage in cases where corroded wires are involved. The *fitted groove* of the connector jaws and bar retards corrosion, due to more complete enclosure.

PERMANENT GRIP: The same features also improve the mechanical strength of the connector. And it's more permanent electrically because the increased mass of the connector, as well as its greater thermal contact with the wire, causes greater dissipation of heat under fault currents.

ALL VISE-TYPE ADVANTAGES: The Spacer-Bar Connector has the same *vibration-proof* vise-type body construction as the regular Fargo solderless one-piece connector. High pressure at wire contact point develops tremendous vibration-proof bind from inside thrust against the vise-type sleeve of the body, thus gripping the conductor with a vise-like action.

Full information on the 7000 Heavy-Duty Spacer-Bar Connector is available in data sheets and performance test graphs on request. Explains details of construction that assure reduction of outages on transmission lines and distribution lines serving large numbers of customers.

FARGO MFG. COMPANY

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)
POUGHKEEPSIE, NEW YORK · EST. 1914

FARGO MFG. CJMPANY, POUGHKEEPSIE, N. Y.

Please send me, without obligation, full information on the 7000 Heavy-Duty Connector.

Name..... Title.....

Company .....

Street .....

City..... State.....

● Back in 1913, Buckingham of Binghamton took over the famous Stephens Climber business—a business that had made Safety its watchword since 1901. Buckingham expanded the Climber line to include Linemen's Belts, Safety Straps, Climber Straps, Pads, Tool Pouches, Knives and other equipment. Every piece carefully designed for comfort . . . rigorously inspected for quality . . . and rigorously tested for safety.

The United States Army Signal Corps, twenty-eight great utility companies, and prominent telephone companies, railroads and fire departments all over America are using Buckingham equipment—finding that it meets the most exacting requirements for safety, for practicality, for comfort and economy.

Write today for Catalogue 24 showing the complete Buckingham line.

Buckingham distributors in many principal cities.

Buckingham Climbers, Series 26—Medium Weights. Shanks shaped to fit the leg. Gaff set close to foot piece—less strain on Climber, more comfort for lineman.

Buckingham Climbers, Series 27—Light Weight offset shank brings spur in alignment with the wearer's center of gravity, prevents Climber from twisting and slipping back on leg.

Buckingham Easy Belt, No. 56R Made of best harness and chrome tan lace leather. Light in weight, yet so constructed that it has ample strength for severest service. Rolled edges. Floating feature in four-loop tool strap for efficient work. Forged Dee-Rings, buckles, individually tested.

Buckingham Featherweight Climber—Average weight 2 lbs. 10 oz. per pair. Rights and Lefts. Ring loops for foot straps.

Buckingham MANUFACTURING CO., INC.

Walter E. Craw, President 5-7 Travis Street, Binghamton, N. Y.

dige's place at Chico. Other appointments include W. L. GREER, who will be the new sales manager of the Sacramento division.

•

Personnel Changes Made by Puget Sound Power

Five changes in personnel have been announced by Puget Sound Power & Light Co.

Charles Boring has been transferred to Seattle where he will be assistant to the general superintendent of operations. For the past 14 years, he has been at

C. Boring

Everett, first as assistant superintendent of light and power, then superintendent. His successor at Everett will be J. L. Marzluff.

Mr. Marzluff served as company transportation coordinator during the war. He has been with the company for 33 years, starting as a lineman in Bellingham in 1912. Among his other positions have been manager of the Renton and Winslow local offices and assistant superintendent of light and power at Bremerton.

Francis H. Ferguson, superintendent of light and power of the Western Division at Bremerton, has been moved to Seattle where he will hold the same position in the Central Division.

Albert M. McDonald, superintendent of distribution in the Central Division, has succeeded Mr. Ferguson as superintendent of light and power for the Western Division. Mr. McDonald started with Puget Sound in 1925 as a lineman. He has been a line foreman, general foreman, and assistant superintendent of the Southern Division.

Frank M. Drebick has succeeded Harold Harmony as manager of the Winslow branch office.

•

▶ GERARD SWOPE, honorary president of the General Electric Co., and recipient of numerous awards for his outstanding achievements in the field of human rela-

K&M EBONIZED ASBESTOS

This modern electrical insulating material—developed specifically for switchboards, bus bar runs, testing tables, panel boards and similar uses—measures up fully to the most rigid requirements encountered in such service.

The dielectric strength of a ¼″ sheet of K&M Ebonized Asbestos will withstand 19,000 volts without puncture . . . a 1″ sheet, more than 53,000 volts.

It has the structural strength needed to hold heavy switches and instruments firmly and securely. It will withstand severe shock, vibration, sudden temperature changes . . . is highly resistant to oil and water . . . and will not shrink, crack or bulge.

The ability of K&M Ebonized Asbestos to meet all service conditions is due to its rugged construction and special composition—a combination of asbestos fibre, binding cement and insulating compound, moulded under high pressure into monolithic sheets of uniform density throughout.

K&M Ebonized Asbestos is available for immediate delivery . . . in thicknesses of ¼″ to 4″, standard or special "panel" finish. It meets the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Protect Now with GRINNELL MULSIFYRE

Breakdown in a 16,000 k.v.a. transformer . . . severe internal arcing . . . relief disc blows out . . . oil is violently ejected . . intense fire envelopes nearby equipment . . . two adjoining transformers let go and add to the fury of the flames. It took a 1½-hour battle to subdue the fire — and $50,000 to replace and repair the damage!

A Grinnell Mulsifyre System now protects the new equipment – as it does the installations of many other public utility transformer stations.

Wide acceptance of Grinnell Mulsifyre Systems is based on a proved effective principle – in which blazing oil is emulsified with a driving spray of water. The oil is turned into a liquid which is incapable of burning – the fire is extinguished in a few seconds – reignition is prevented.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages. Mulsifyre Systems are permanently installed – are constantly on guard when operated automatically – or may be operated manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard – in transformers and other oil-filled electrical equipment.

Don't wait for fire to strike! See that your equipment has this 24-hour-a-day protection from now on. Grinnell engineers will help you plan protection for your specific needs.

GRINNELL COMPANY INC.

Executive Offices, Providence 1, R. I.
Branch offices in principal cities.

GRINNELL *Mulsifyre*

AUTOMATIC FIRE PROTECTION

tions in industry, received in absentia the American Society for Metals' gold medal award for his accomplishments in promoting research for the increased use of metals. The award was made at the annual meeting of the society held on February 7 in Cleveland.

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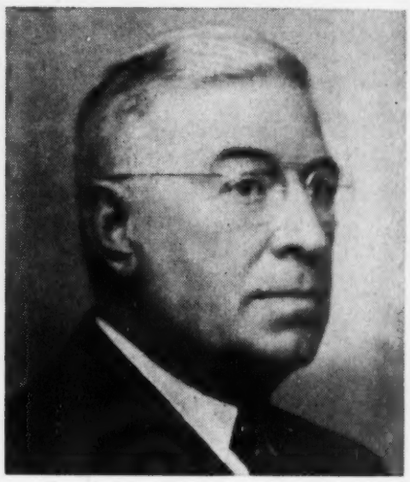
W. Weaver New President of Ansonia Electrical Co.

William J. Weaver, since 1942 vice-president in charge of operations for The Ansonia Electrical Co., wholly owned



W. J. Weaver

subsidiary of Noma Electric Corp., has been elected president of Ansonia. He was formerly associated with the Bryant Electric Co., a subsidiary of Westinghouse Electric Corp., for 20 years.

A. P. Lunt, chief engineer since 1943, was elected a vice-president.

•

▶ HOYT L. TAYLOR, utilities engineer for the City of Louisville (Ky.) for the past ten years, has resigned to open an office for utilities and industrial engineering studies in Louisville.

▶ E. S. EVANS has been appointed to the position of secretary of the industrial relations committee of the Edison Electric Institute. In his new position, Mr. Evans will collect and compile statistics and other data on industrial relations for member companies of the Institute, and will serve as a source of information on all phases of employee relations and kindred subjects for the electrical industry. Mr. Evans brings to the Institute more than ten years' experience in several fields of industrial relations work. In his last connection, he was with the Employer's Advisory Council, assisting industry members of the 2nd Regional War Labor Board in research and case preparation. His work included the counseling of industries in the preparation and presentation of dispute cases to the board. Previously Mr. Evans was personnel manager

(Advertisement)

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Looking Ahead For 1946

Indications are that 1946 will be a busy year for power plants because of the great amount of modernization and new construction planned. The continued increase in the use of electricity in the fields of transportation, communications, housing and many branches of industry keeps the power consumption curve generally upward. It follows therefore, that as electricity continues to find more uses in industry and new applications in the home and on the farm, many power plants must increase their capacities either by modernizing or by adding new equipment.

Planning Future Growth

What has been learned from the war? During those difficult years, power plant operators were called upon to produce more and more electric power despite the added burdens of inadequate manpower, fuel shortages, and material restrictions. The fact that power plants came through with flying colors can be credited to far-sighted management policies which made possible the extension of capacities considerably beyond normal, and the ingenuity of the engineer which enabled plants to operate despite overloaded equipment badly in need of replacement.

Those plants which had good condenser tubing made from the most corrosion resistant alloys were in a very favorable position because they could stand overloading. On the other hand, plants with poor, worn out condenser tubes had to nurse them along. Restrictions in copper and brass for the war effort therefore placed a greater hardship on plants which could not take advantage of the more corrosion resisting alloys.

Trend Toward Better Alloys

Since the type of condenser tubes used has a very important bearing on the efficiency and operating expense of power plants, the trend is toward the use of more corrosion-resistant alloys. There are many factors which have an adverse effect on the life of condenser tubing—faster steam condensation which requires high circulating water velocities; and increasing contamination of water by chemical and industrial wastes. Many operators are studying these conditions as they apply to their power plants.

They are carefully observing the life of test installations of various condenser tube alloys in order to learn which one is best suited to their particular circulating water and operating conditions.

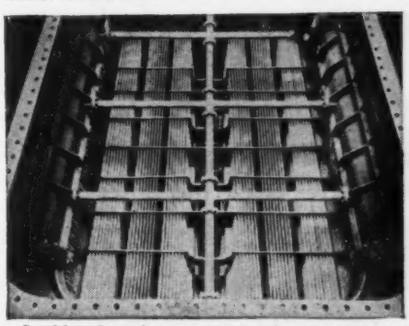
Increased Efficiency Necessary

There are additional factors which management must take into consideration when planning for the extension and modernization of power producing facilities. The cost of labor is rising and there seems to be little prospect of materials selling for lower prices. Consequently, increased efficiency will go a long way toward offsetting these conditions.

One of the most important factors in improving the efficiency of power plants is the use of modern corrosion-resistant condenser tube alloys. Operators can choose from a number of fine alloys which have been developed through extensive research in the field of corrosion as well as along metallurgical lines. A large number of field and service tests have been carried out in cooperation with power plant operators by our Technical Service Department made up of laboratory-trained men, some of whom specialize in corrosion. These tests help determine what results may be expected of the various condenser tube alloys under actual operating conditions. Such programs bring beneficial results both to producers and users of tubing. The trend is toward greater cooperation between the manufacturers and operators.

Less Frequent Retubing

Metallurgical research has accomplished a great deal in developing alloys to resist dezincification, impingement, general thinning and other types of corrosion. Improved equipment and processing techniques have brought forth fine corrosion-resistant alloys, such as Duronze IV (aluminum brass), cupro nickel and cuzinal (aluminum brass) which stand up longer under corrosive water conditions and high water velocities.



Looking down into an open surface condenser

From the standpoint of economics it may be cheaper in the long run to use a more expensive corrosion resisting alloy. This will bring down the condenser-service-hour-cost because of its longer life—less frequent retubing and lower maintenance.

Much technical information on corrosion, characteristics of various alloys, specification data, etc., is contained in Bridgeport's 112-page Condenser Tube Manual. Write for your copy on company stationery.

Corrosion and Biofouling of Copper-Base Alloys in Sea Water

Engineers and metallurgists interested in the corrosion resistance of copper-base alloys in sea water, will find much valuable data in a paper prepared by C. L. Bulow, Research Chemist of Bridgeport Brass Company. This appeared in the Transactions of the Electrochemical Society 1945, 87, 319.

During June, 1942, plans were laid for making an extensive sea water corrosion test. It was hoped that information would be obtained concerning thirty copper-base alloys which could be used as standard reference values in connection with their corrosion resistance in clean sea water. Further consideration of the problems involved in such an extensive test led to the use of the excellent facilities available at the International Nickel Company's sea water corrosion test station at the Ethyl-Dow Chemical Company, Kure Beach, N. C. This paper is a preliminary report covering the results obtained during the first year of testing at this site.

A total of 240 test pieces of copper alloys, of widely varied composition, were exposed to clean flowing sea water (60 to 90 cm./sec.) for periods of six and twelve months, during which the water temperature ranged between 2 deg. and 30 deg. C.

Alloys tested include Muntz Metal, high brass, cartridge brass, commercial bronze, various coppers, admiralty, aluminum brass, naval brass, manganese bronze, phosphor bronze, silicon bronzes, aluminum bronzes and cupro nickels. Corrosion rates of the different alloys are discussed and data presented on loss in tensile strength and weight, impingement corrosion as well as general surface pitting. There are also data on the effect of alloying elements such as arsenic, aluminum and iron. There are 19 tables, 8 sets of curves as well as descriptive material and photographs.

We shall be glad to supply reprints of this paper. Kindly address your request on company stationery.

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BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

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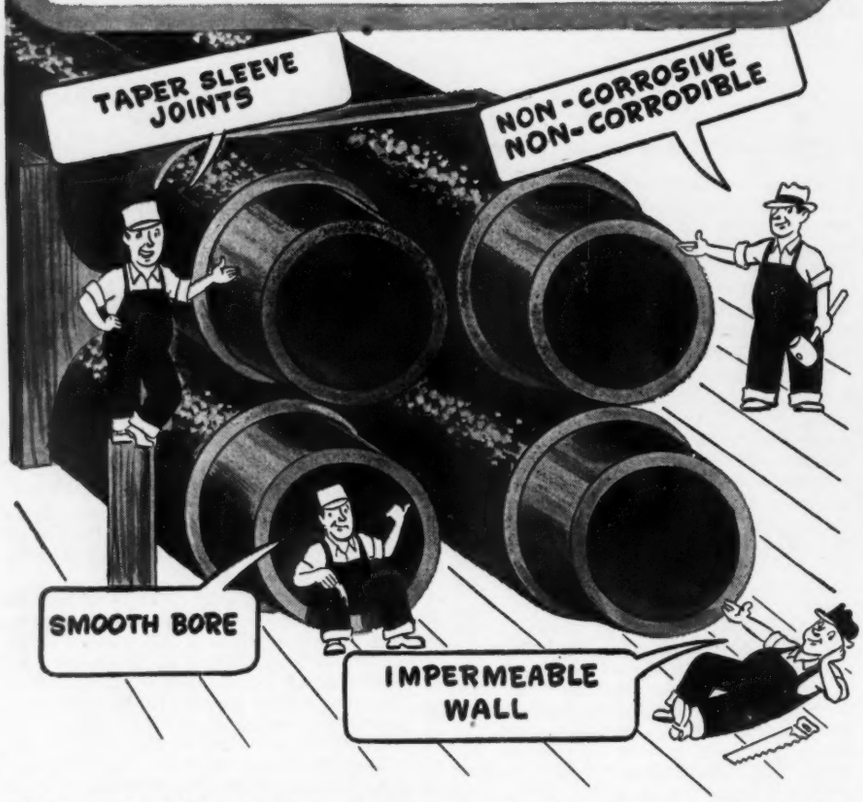

Cable is the lifeline of power and communications systems. Give it this vital 4-way protection with ORANGEBURG* CONDUIT . . . .

1. **Protection** from cable sheath abrasion . . . because of its smooth bore, ORANGEBURG reduces the danger of damage to the sheath when cable is pulled into duct.

2. **Protection** from pulling tension . . . because the friction coefficient is lower in ORANGEBURG than in ducts made of other materials, lessening strains caused by cable pulling tension.

3. **Protection** from water infiltration . . . because ORANGEBURG'S impermeable wall gives cables maximum safety from ground water and resulting corrosion.

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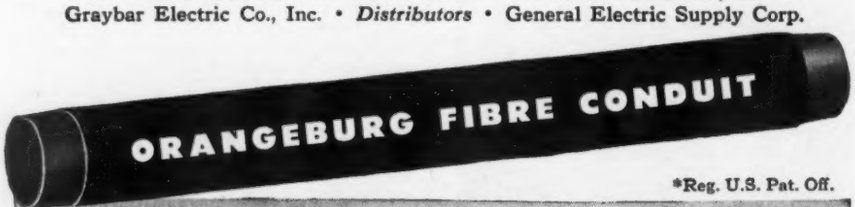

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WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

of General Cable Corp.'s largest plant at Rome, N. Y., and had also held the same position at the Shelton, Conn., plant of Sidney Blumenthal & Co. Mr. Evans has also spent four years in employment activities, specializing in executive and engineering positions.

•

James H. Kellogg Heads Switchboard Supply Co.

In a series of changes in the officers of the Kellogg Switchboard & Supply Co., Chicago, James H. Kellogg, vice-president, secretary, and works manager, has

J. H. Kellogg

succeeded his father, James G. Kellogg, as president of the company. The elder Mr. Kellogg has been elected chairman of the board.

Other new officers are Harry C. McCluskey, former treasurer, executive vice-president and treasurer; Claude D. Manning, former assistant to the president, vice-president and secretary; and Harvey O. Edson, who was made assistant secretary and assistant treasurer.

Starting as an order clerk in 1936, the new president progressed through various positions to that of works manager in 1943, later becoming vice-president and secretary.

•

► STEPHEN B. SEVERSON, formerly vice-president and general manager of the Republic Light, Heat & Power Co., Inc., has been elected president of both the Republic corporation which serves western New York towns, and the Dominion Natural Gas Co., Ltd., which serves Ontario towns. Mr. Severson became vice-president and general manager of the companies in 1924.

► HOWARD COONLEY has been appointed head of the newly organized executive committee of the American Standards Association. Mr. Coonley, who has retired from active duties with the Walworth Co., is a former president of ASA

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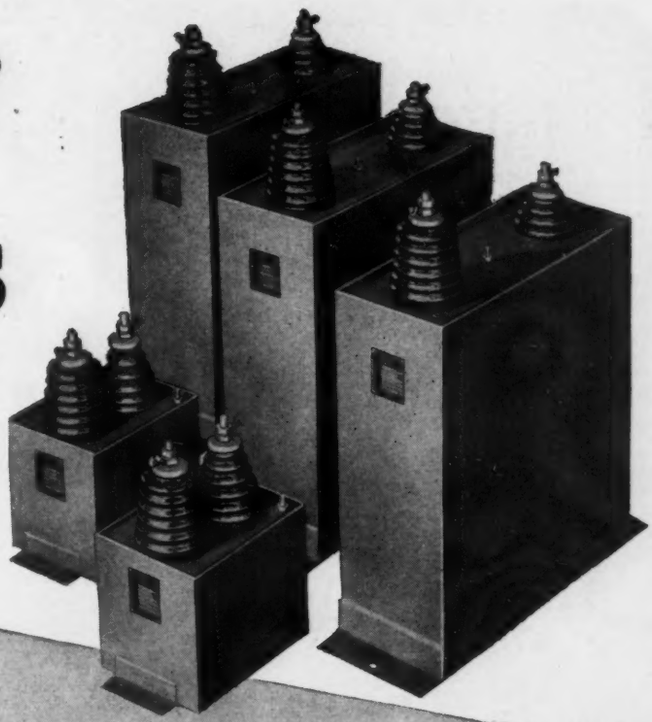
CAPACITORS
... engineered by AEROVOX



Aerovox Series 20 Hyvol impregnated and filled capacitors in ratings up to 50,000 v. in hermetically sealed welded steel cases.

Aerovox Series 26 stack-mounting Hyvol impregnated and filled capacitors in ratings up to 150,000 v. Laminated bakelite cases. Cast-aluminum terminal ends.

● For those extra-severe-service applications on the largest capacitors, as well as others, Aerovox units have the extra stamina that makes them last. Decades of specialization provide an experience background second to none in solving all kinds of capacitor problems; unexcelled production facilities assure QUALITY as well as quantity.

Aerovox capacitors are liberally engineered for their individual applications. Special multi-layer capacitor tissues . . . long-life, non-inflammable Hyvol impregnant and fill . . . constant filtration and testing of impregnant as regular production routine . . . thorough evacuation and impregnation . . . positive hermetic sealing—these facts of Aerovox craftsmanship spell long, trouble-free service.

Aerovox capacitors in daily use speak for themselves. No finer capacitors are built. Aerovox engineers stand ready to meet your most severe requirements.

Submit your capacitor problem. The tougher the better! Write for literature.

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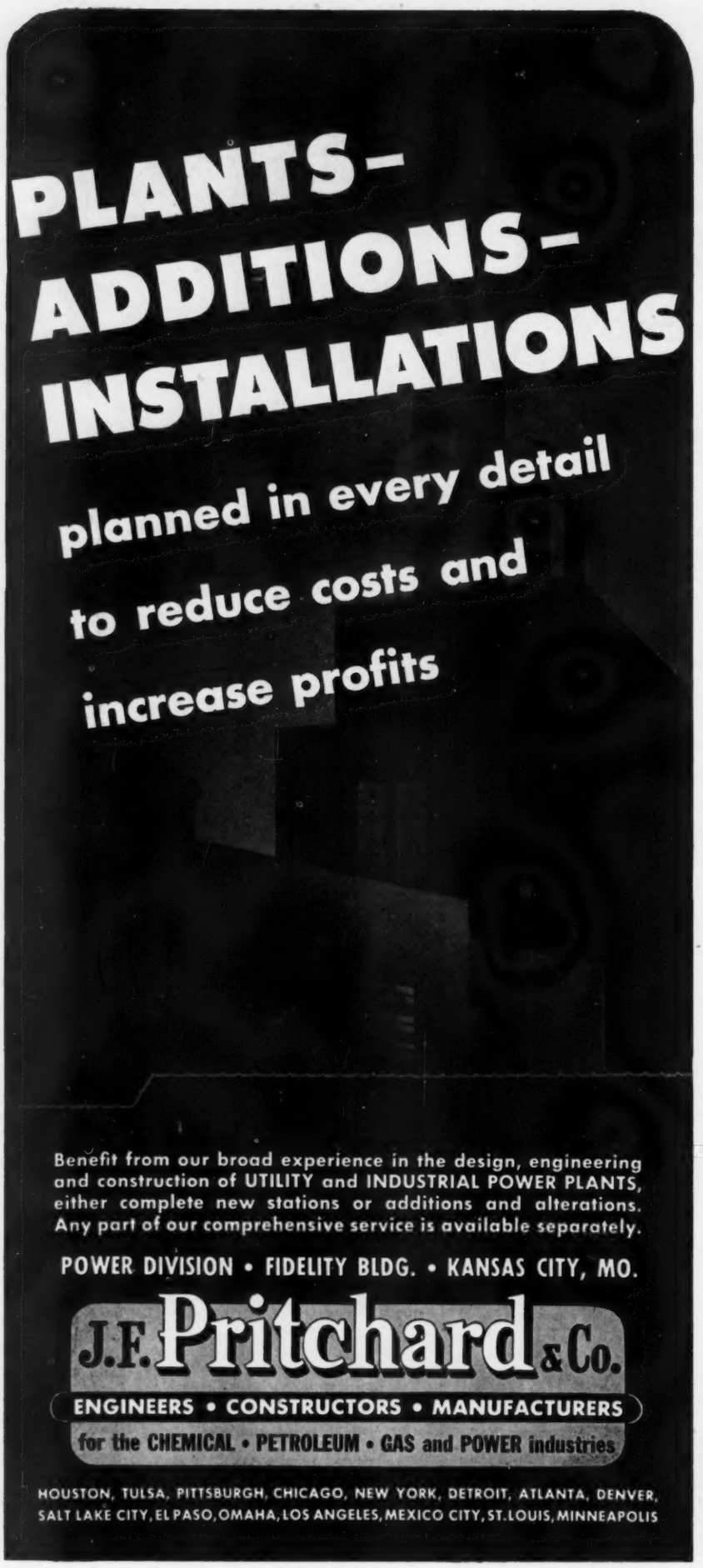
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planned in every detail
to reduce costs and
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Benefit from our broad experience in the design, engineering and construction of UTILITY and INDUSTRIAL POWER PLANTS, either complete new stations or additions and alterations. Any part of our comprehensive service is available separately.
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ENGINEERS • CONSTRUCTORS • MANUFACTURERS
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and of the National Association of Manufacturers. Work of the new committee will have to do with financial, administrative and executive direction of the association and expansion of activities.

▶ WALTER L. KELLEY, JR., for the past six years illuminating engineer, Blackstone Valley Gas & Electric Co., Pawtucket, R. I., has been appointed industrial service engineer of the New England Machine & Electric Co., Pawtucket, and will cover southern New England in connection with lighting and power developments. Mr. Kelley was with the Blackstone Valley company for 12 years, and prior to that with the Narragansett Electric Lighting Co., Providence. For the past seven years he has been a director of the Lighting Engineers Club of New England and is also a member of the I.E.S. committee to study lighting in the textile industry, besides being active in the Power Engineers Club of New England.

▶ J. C. HENKLE has been appointed general superintendent of the Portland General Electric Co. to succeed C. P. OSBORNE, whose appointment as operating consultant was announced simultaneously. Mr. Henkle has been 37 years with the company and for the past three years has been assistant to Mr. Osborne. An engineering graduate of Oregon State College, he began as a wireman and subsequently became foreman, superintendent of electrical maintenance and construction, and assistant general superintendent. Mr. Osborne, who has reached retirement age, has been general superintendent since 1924.

▶ WILLIAM F. JETTER, formerly assistant to the president of the Air Preheater Corp., Wellsville and New York City, has been elected a vice-president of the company.

▶ F. W. BUSH has been appointed assistant manager of the electrical department of the Allis-Chalmers Manufacturing Co., Milwaukee, and F. C. LUDINGTON, now acting manager, has been named manager of the switchgear and control sections, electrical department.

▶ FRANK M. OGLEE has been appointed manager of sales in the Norwood, Ohio, plant of the Trumbull Electric Manufacturing Co. Mr. Oglee has been manager of the Atlantic sales district previous to this new assignment. He has had extensive sales experience both in western and eastern sections of the country. Mr. Oglee is a member of the American Institute of Electrical Engineers and of the Electric Association of Philadelphia. HOWARD S. SMITH has been named as sales supervisor of farm and residential products for the company. Mr. Smith has been active in the development and promotion of elec-

SNACK BAR FOUNTAIN . . .
TAVERN . . . RESTAURANT . . .

Griswold Electric Cooking Equipment
Builds Load 24 Hours Daily Here!

HERE is the Griswold 1200 meat grill, with cast iron grids for adequate heat reserve, a constant, dependable load builder for the back bar, counter, (and display window too!) in modern eating places. 3.0 kw connected load and always on the job throughout every day and all night in many spots for quick snacks, this Griswold unit is one of a parade . . . the Griswold 1100 Sandwich Grill with aluminum grids, waffle bakers, hot plates, food servers to help you in your load-building program. Griswold thermostatic controls, quick heating, modern tilting adjustments for speedy grease drainings, accessibility for cleaning and strictly modern appearance are features that cannot be overlooked in recommending selection of electric cooking equipment . . . every unit a load builder for you . . . *Your equipment house will cooperate in recommending the correct Griswold unit for each requirement.*

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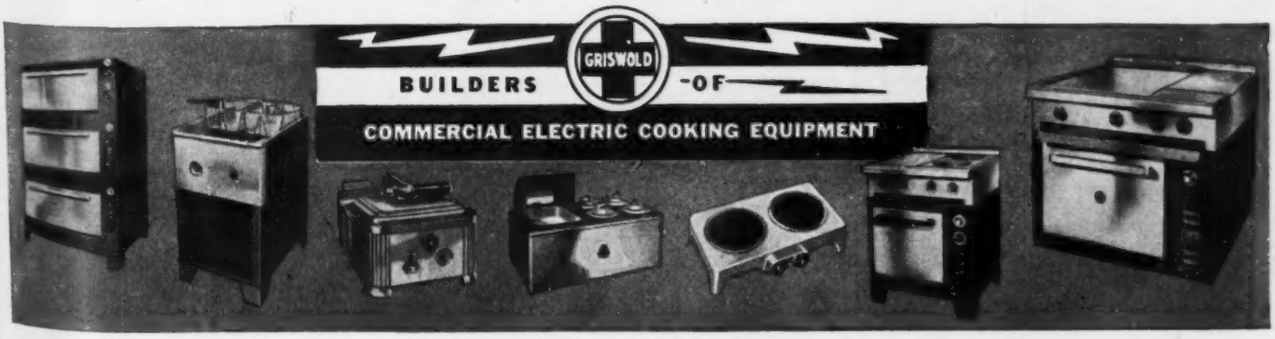

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DECK FIXTURE formerly aluminum casting now made by EASY-FLO brazing steel stampings and Bronze ring.

. . . IS THE FAST LOW-COST WAY TO FABRICATE Electrical EQUIPMENT

Today, a wide variety of electrical, equipment such as switch boxes, enclosures, lighting fixtures are made by SIL-FOS or EASY-FLO brazed construction. Constantly, more and more such equipment is being redesigned or newly designed for this simplified fabricating method. Here are two compelling reasons why.

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tric farm production equipment. His new assignment includes the further responsibility for development of the residential market on meter entrance and distribution devices.

▶ ROBERT S. KNAPP, son of A. S. Knapp, president and founder of the Knapp-Monarch Co., has been elected vice-president of the company. He has been associated with the business since 1938 and has been on leave for military service since 1941. He recently completed a study of German industrial techniques in the iron and steel industry for the War Department.

▶ CHARLES G. LANPHIER, vice-president in charge of purchasing, Sangamo Electric Co., Springfield, Ill., has retired after 37 years with Sangamo. HARRY C. CHAMBERS has been appointed purchasing agent. The purchasing department becomes a division of production control under Russell C. Bennett, vice-president in charge of production.

OBITUARY

▶ WILLIAM M. WILLETT, vice-president and a director of the Western United Gas & Electric Co., Aurora, Ill., died on January 29 at his home in that city. He was 70 years of age. Mr. Willett started with Western United in 1896. He served for many years as general manager of the company before he was elected a vice-president in 1931.

▶ ROBERT H. MORRISON, for the past 13 years superintendent of lines for the northern division of the Carolina Power & Light Co., Raleigh, N. C., died on December 24. Mr. Morrison had been connected with the Carolina utility for 26 years.

▶ BENJAMIN T. HARE, vice-president of the Rumsey Electric Co., Philadelphia, died on January 14. Mr. Hare had been prominently identified with the electrical wholesaling industry for the past 40 years. He was active in the affairs of the National Electrical Wholesalers Association and other allied associations.

▶ FRANCIS J. CONNOLLY, formerly manager of the Electrical Contractors Association, and until last September, manager of the southern California chapter of Associated General Contractors in Los Angeles, died on January 14. He was 52, and prominent in electrical and construction fields, having been associated with many of the larger construction projects in the city and adjacent areas, including Boulder dam and the Metropolitan Aqueduct. Born in Waltham, Mass., Mr. Connolly went to southern California 30 years ago.

Peter A. McCarron

P. A. McCarron, vice-president, Pottsville-Schuylkill divisions of the Pennsylvania Power & Light Co., died in Pottsville on February 9 of a heart condition at the age of 65. Born in Everdale, Pa., Mr. McCarron started as fireman in a small electric plant in McAdoo, Pa., nearly 40 years ago. In the course of his association with Pennsylvania Power & Light, he worked his way up to the division vice-president's position in charge of company operations in Schuylkill, lower Northumberland, lower Columbia and eastern Dauphin counties.

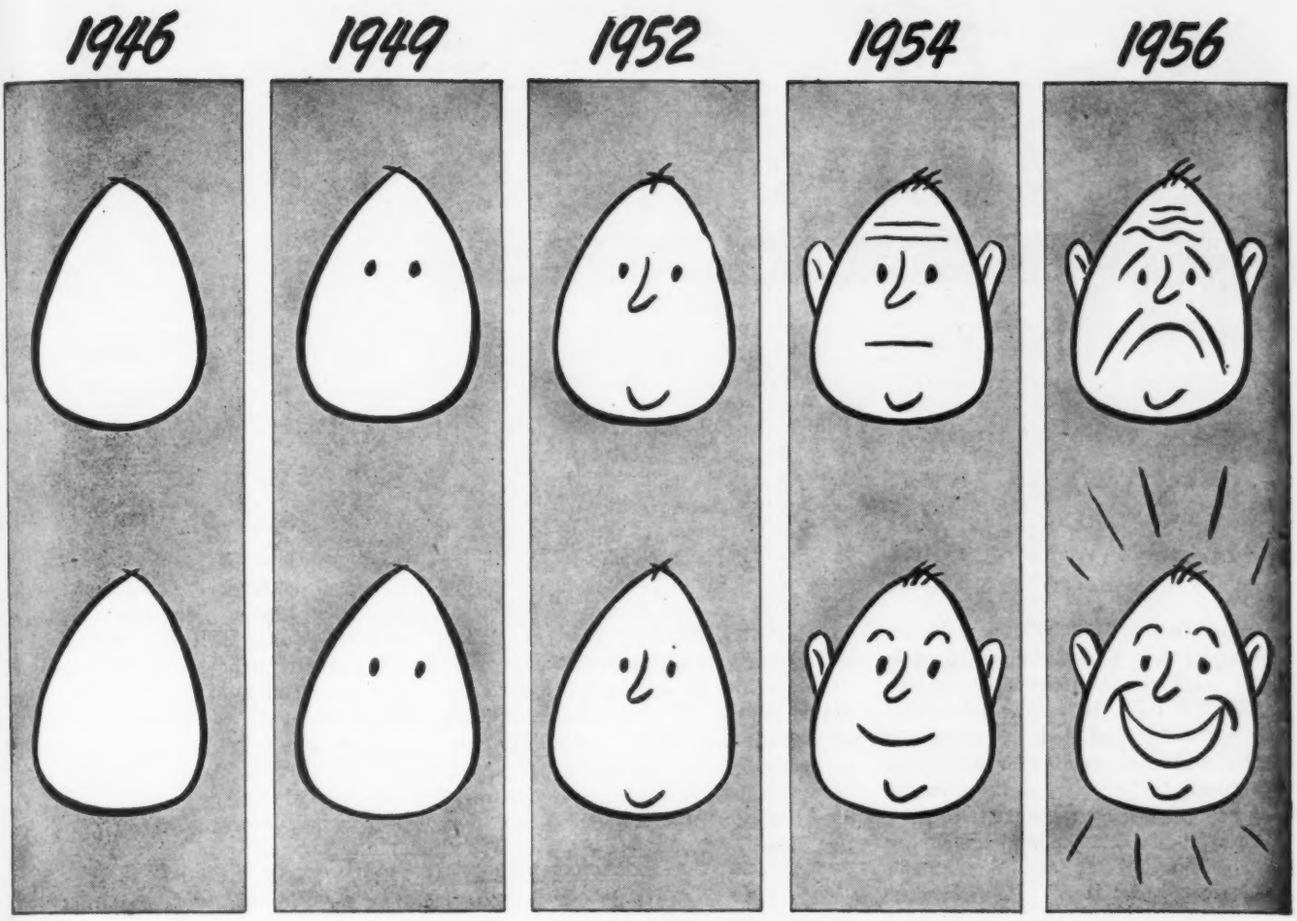
Active in Pottsville civic affairs, he was a former president of the Chamber of Commerce and organizer of Pottsville Industries, Inc.

•

▶ THOMAS B. MCELRAY, electrical superintendent of Carnegie-Illinois Steel Corp. in Youngstown, Ohio, died on December 26 of a heart attack. He was 63 years of age.

▶ HARRY B. IVERS, 67, general manager of the Wareham division of Plymouth County Electric Co., died at Wareham, Mass., on January 16. He was born in Bear River, N. S., and in early life was employed in the electric railway field, later becoming manager of traction properties at Bangor and Lewiston, Me. Subsequently he was made general manager of the Cumberland County Power & Light Co., Portland, Me., and then engaged in appraisal engineering at Boston for four years. There was an interim in private business, and then Mr. Ivers joined the then C. D. Parker & Co. utility financing and management organization at Boston, and in 1928 was appointed to his late position, then identified with the Southeastern Massachusetts Power & Light Co., now managed by the New England Gas & Electric Service Co.

▶ ROGER D. DE WOLF, formerly connected with utility companies in New York and Pennsylvania, died on February 2 at the age of 66. A native of Toledo, Ohio, and a graduate of Ohio State University, Mr. De Wolf was a member of the engineering and research staff of Western Electric Co. in Pittsburgh from 1901 to 1909 and held supervisory positions with the Rochester Gas & Electric Corp. until 1930, afterward working for two years as supervising engineer for the Utilities Management Co. in Reading, Pa. After operating his own furnace company in Rochester for ten years, he went to Kansas in 1942 to become chief construction engineer on the Sunflower Ordnance Plant built by the du Pont interests with Government financing.



Two ways your face can grow in the next few years

USUALLY, our faces show what's happening to us. For instance, suppose financial matters are constantly on your mind.

Suppose you know that there's practically no cash reserve between you and trouble.

It would be surprising if your face didn't show it.

But suppose that, on the contrary, you've managed to get yourself on a pretty sound financial basis.

Suppose that you're putting aside part of everything you earn . . . that those dollars you save are busy earning *extra* dollars for you . . . that you have a nest egg and an emergency fund.

Naturally, your face will show *that*, too.

There's a simple and pretty accurate way to tell which way your face is going to go in the next few years:

If you are buying, regularly, and holding as many U. S. Savings Bonds as you can, you needn't worry.

Your face will be among the ones that wear a smile.

Buy all the Bonds you can... keep all the Bonds you buy

ELECTRICAL WORLD

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

MANUFACTURING MARKETS

4,000,000 New Lights Needed on Highways

$500,000,000 Worth of Street Lighting Equipment Would Cut Accidents Even with 40,000,000 Cars

A minimum of 4,000,000 new luminaires or light fixtures for approximately 50,000 miles of automotive thoroughfare and 250,000 miles of residential streets at an estimated installed cost of $500,000,000 will be needed for new and replacement traffic safety lighting in the United States during the next ten years, according to a recently completed survey of America's lighting conditions made in Schenectady by Dr. A. F. Dickerson, manager of General Electric's Lighting Division.

Programs collectively entailing this amount of lighting improvement must be realized if the rising tide of automotive accident casualties is to be curbed, Dr. Dickerson said. With the added aspect of a predicted 40,000,000 cars on the road by 1950, such a national lighting budget is made even more important, he declared.

Estimated need for the next ten years is based on survey findings that most accidents occur on 4 percent of 500,000 miles of designated highway and on 10 percent of 300,000 miles of city streets. These percentages, amounting to 20,000 and 30,000 miles respectively, total 50,000 miles of needed lighting of various types and strengths. In addition, practically all lighting on residential streets badly needs modernization, Dr. Dickerson claimed.

Five main items making up the total estimate are as follows: 400,000 new fixtures at $80,000,000 for 5,000 miles of business streets; 1,000,000 new fixtures at $150,000,000 for 25,000 miles of traffic arteries; 500,000 new fixtures at $90,000,000 for 5,000 miles of freeways, or over and under pass "super" highways; 600,000 new fixtures at $80,000,000 for 15,000 miles of highways, mainly the approaches to cities and highways through villages; and 1,500,000 new fixtures for residential streets.

Such a schedule of new lighting could double the presently existing number of main thoroughfare luminaires or light fixtures in the country, Dr. Dickerson said.

"The need for relighting America is rapidly being acknowledged," Dr. Dickerson said. "Contacts made necessary by the survey seem to indicate a new trend in which the public, municipal officials and utilities are all approaching accord."

Many cities already have prepared programs calling for expenditures of from $3 to $8 per captita for new installations, he indicated. One city, Chicago, already has voted a $3,000,000 bond issue as a first leg of a total $10,000,000 lighting plan.

•

Will Complete Purchase of $500,000 in Equipment

Installation of $500,000 in new manufacturing, processing and development equipment, started in 1945, will be completed this year, according to Henry F. Dever, president of Brown Instrument Co., Philadelphia industrial instrument division of Minneapolis-Honeywell Regulator Co.

During the past year, said Mr. Dever, the company acquired and installed $250,000 in new and modern machine tool equipment, constituting, he added, part of the recently announced over-all expansion plan of the entire Honeywell organization. The Philadelphia division will retain additional branch sites, acquired during war years, it was added, and will make other organizational changes.

•

Radio Frequency Heating Equipment Firm Formed

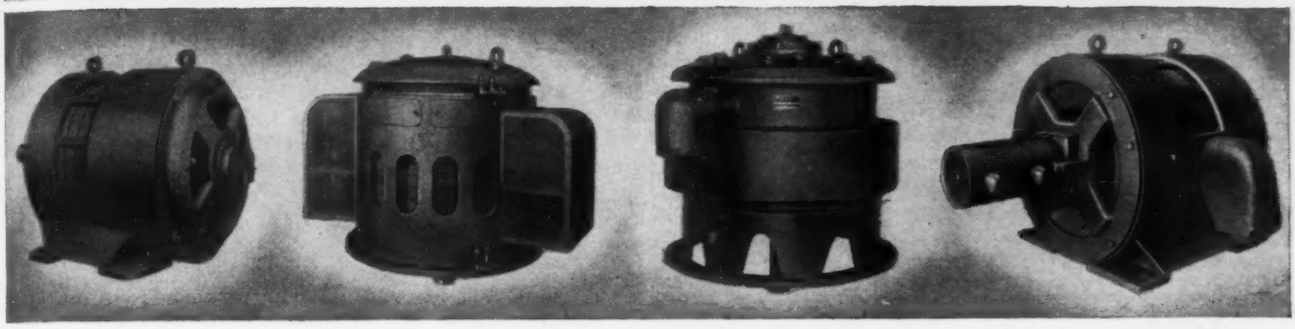
The Concord RF Corp. (Concord, N. H.) has been formed to manufacture high frequency heating equipment. The first product which will be manufactured is a radio frequency transformer for both dielectric and induction heating. Other developments, which are now in the laboratory stage, are expected to appear soon.

Officers of the new company are: president, Sidney Stockwell, president of Davis and Stockwell Transformer Companies; sales manager, Howard Hamilton, sales manager, Davis Transformer Co.; chief engineer, Joshua G. D. Manwaring, formerly with Raytheon small tubes division; and production engineer, Louis D. Holcombe, of Davis Transformer Co. The company, whose capitalization consists of 200 no par common shares, began production February 1 in quarters leased from the Davis Transformer Co.

FIRST UNIT—Officers of the Concord RF Corp. examine first unit produced. Left to right, S. Stockwell, H. Hamilton, J. G. D. Manwaring, and L. Holcombe

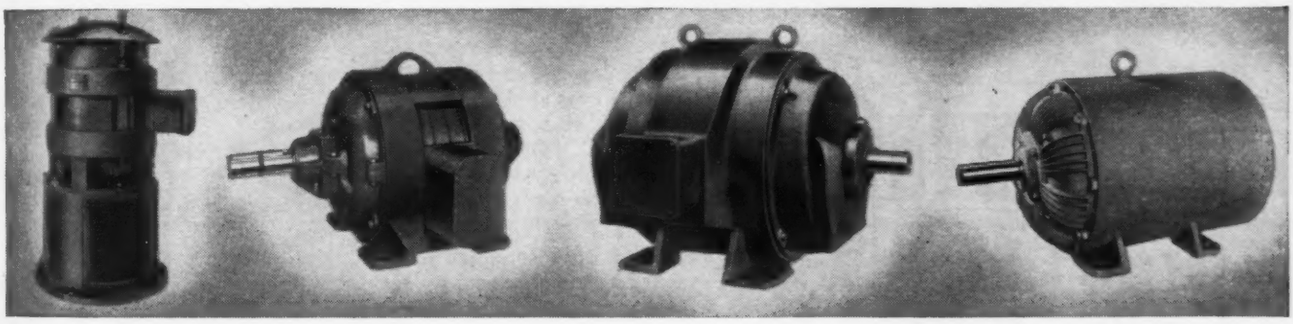
THERE'S ONE CORRECT INDUCTION MOTOR

• *that best fits into your plant*



200 Hp. Induction Motor | 400 Hp. Vertical Ind. Motor | 200 Hp. Squirrel Cage Vertical Ind. Motor | 300 Hp. 4-Speed Squirrel Cage Ind. Motor

25 Hp. Vertical Ind. Motor | 250 Hp., 1800 r.p.m. Ind. Motor | 30 Hp. Splash-proof Ind. Motor | 40 Hp. Fan Cooled Ind. Motor



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They may be multi-speed, drip and splash-proof, enclosed, enclosed fan cooled, vertical, flange, round frame and in sizes from 1 to 1500 H. P.

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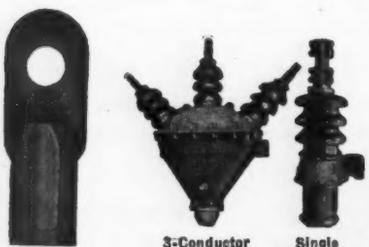

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Predicts $4.5 Billion in Electrical Business

Westinghouse Vice-President Says Electrical Living Will Provide Jobs for over 600,000 Persons

The modern age of electrical living now dawning in American homes will mean an annual business of $4,500,000,000 during the next five years and provide jobs for more than 600,000 men and women. This prediction of B. W. Clark, vice-president in charge of sales for Westinghouse Electric Corp., was given to metropolitan newspaper and magazine editors at a preview of the company's 1946 home consumer products in New York City recently.

Theme of the preview was set by a color film, "The Dawn of Electrical Living," the company's contribution to the industry program of informing the public of the importance of adequate wiring in new and old homes.

"As an example of how electrical living is taking hold, the average home consumer in 1935 used 600 kw.-hr. of electricity per year. In 1942 that consumption had reached 1,022 kw.-hr., and—in spite of the fact that no new appliances were being made—it reached more than 1,200 kw.-hr. per year in 1945. That translates into a total use of 30,000,000,000 kw.-hr. per year, or at an average of 3 cents per kw.-hr., $900,000,000 per year. The unit rate is little more than half what it was more than ten years ago, another fact that has contributed greatly to the rapid growth in home use of electricity," he said, and continued:

"If the rate of growth continues, as we surely expect it will, and the new homes are built and more farms are electrified, the utilities should in 1955 be serving 35,000,000 homes and delivering 2,200 kw.-hr. per year each, or 77,000,000,000 kw.-hr. If the rate remains the same, we see in ten years a home market of more than $2,000,000,000 annually for electricity alone."

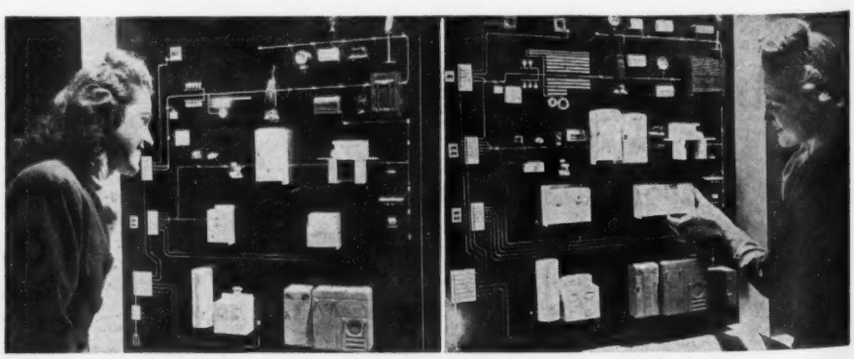
Pointing out that equipment required to generate and distribute electricity to homes costs nearly as much as the appliances which use the electric current, Mr. Clark said that he believed "a fair figure for capital investment in generating plants, substations, transmission and distribution lines is $1,000,000,000 per year for the next five years, as applicable to the home load alone.

"Added to this are the requirements of existing homes. Almost all of these are inadequately wired or improperly protected for the use of the loads to be placed upon them by the rapid increase in electric utilization. At least $150,000,000 per year for several years should be expended in wiring costs in the remodeling of our millions of existing homes."

Mr. Clark estimated the annual demand for electric appliances in these new and existing homes at: electric refrigerators, 3,000,000; electric ranges, 800,000; washing machines, 2,500,000; vacuum cleaners, 2,000,000, and radios, 5,000,000.

"At average expected prices," he said, "these items total $1,300,000,000 in sales volume per year for five years. If we add the business in appliances not mentioned—such as flatirons, roasters, toasters, coffee makers, room heaters, sun and heat lamps, lighting lamps and fixtures—here is an annual market of more than $2,000,000,000 a year in utilization devices."

In a financial analysis of the business of electrical living, Mr. Clark pointed out that improved wiring in new and remodeled homes would cost more than $215,000,000 yearly; small and large appliances, from lighting fixtures to refrigerators, will have a market demand of more than $2,000,000,000 a year; expanded electrification and increased power demands for the appliance-conscious public will require annually from $1,000,000,000 in 1946 to $2,000,000,000 in ten years for electricity, and new capital investment by the utility



ELECTRICAL LIVING PATTERN—"Budget" degree of electrical living (left) and the "Deluxe" installation are shown on the board which depicted four degrees of domestic electrical application. "Budget" incorporates major appliances, a limited amount of fluorescent lighting, standard lighting fixtures and adequate wiring to serve the load. "Deluxe" is for complete comfortable electrical living and incorporates more appliances, utilizes fluorescent almost entirely, and is served by more circuits

companies to provide this power will exceed $1,000,000,000 a year.

"Here then," he continued, "in the business of equipping and running homes electrically is a market that, dollarwise, approximates $4,500,000,000 annually and will—for at least five years—if we all work at it."

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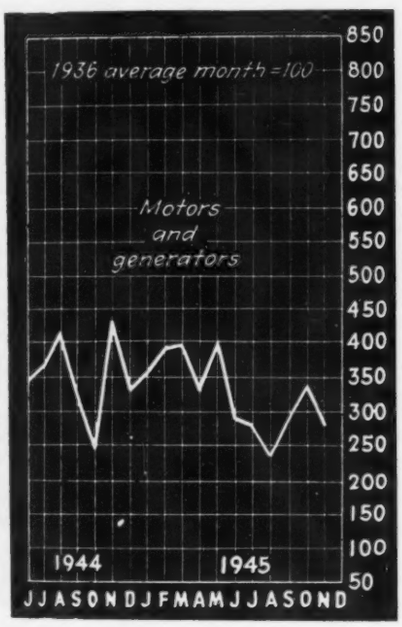
New Generator Orders Decline 17 Percent

Orders received for motors and generators during the month of November dropped 17 percent in comparison with



NEMA index, value of orders received

October orders, according to figures released by the National Electrical Manufacturers Association. The index compiled by NEMA moved down to 286 from 344 in October. In November, 1944, the index stood at 432, this year's figure representing a loss of 34 percent.

The 1944 monthly indexes include an adjustment for cancellations reported up to December 31. No adjustment has been made for renegotiation of contracts.

•

Opens Employees' School

York Corp. recently opened its Institute of Refrigeration and Air Conditioning, a school for employees designed to meet the company's needs for a "thorough educational program" in engineering, production, sales, service and factory management. The school has a potential capacity of 1,000 students annually. The institute will provide courses ranging from a two-week refresher course to a five-year cooperative engineering course, run in conjunction with Pennsylvania State College.

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MODEL 251 (illustrated). Triple range: 0-12.5, 0-125, 0-1250 ohms. Recommended for average ground conditions.

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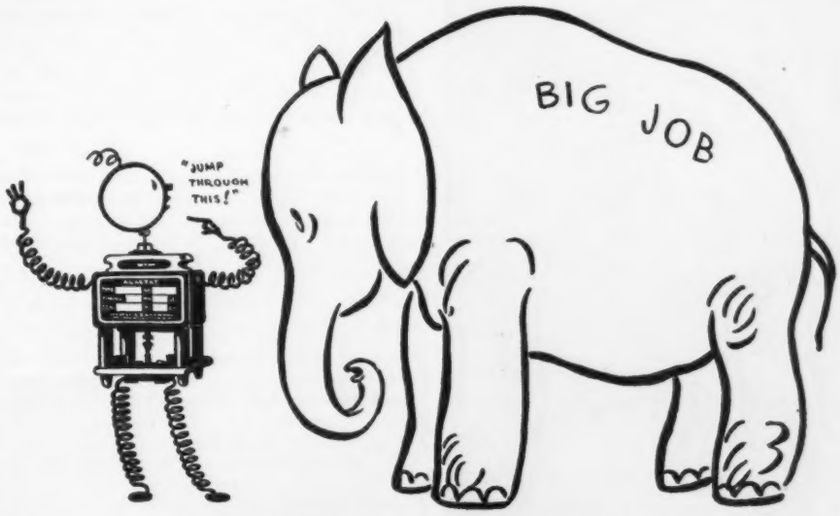

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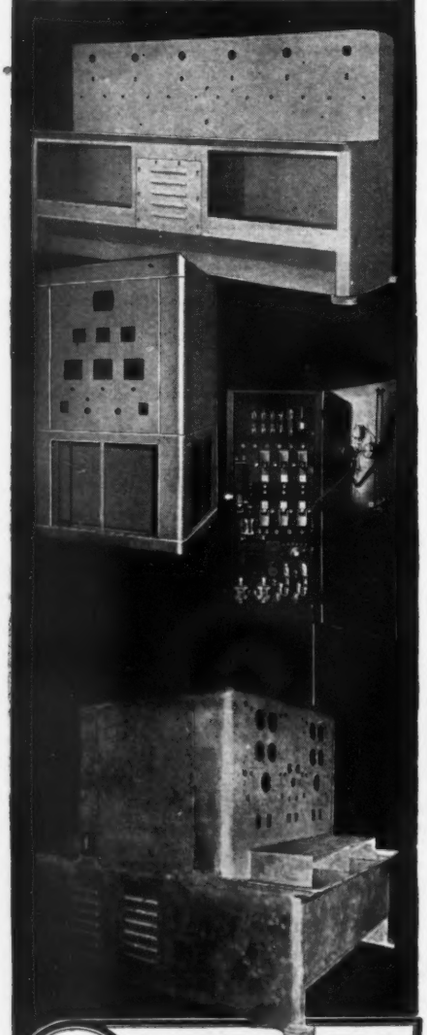

LITTLEFORD

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Field Reports on Business

The possibility that all commercial, industrial, and costly residential construction will be curtailed to channel scarce materials into emergency, low-cost homes, was predicted this week by John D. Small, CPA administrator, who warned that even projects under construction may be halted.

PACIFIC COAST

Bay Region plants are hopeful that the machinists' strike which has crippled them by picketing since last October is approaching a settlement. An 18½ percent pay increase was refused last week, but a division of opinion in the union was later reported. Many large electrical orders and plant renovations are being held, pending this strike's end.

Pacific Coast stocks are still extremely spotty, but a fair proportion of the average order can still be shipped and the situation is slowly improving, except in fluorescent lamps. Merchandise shipments are better, but long standing allocations prevent any stock accumulations. Price advances in ballasts, specialty transformers for signalling and neon work, vacuum cleaners, and wire-molding material are reported, all except the last, which is a straight 10 percent, being on the basis of the same dollars and cents increase per item to wholesalers, dealers, and contractors alike.

Pacific Gas & Electric Co.'s expansion plans include $1,752,000 for the North Bay area to cover a stepdown substation at Fulton and a 110-kv. transmission line from the main line near Winters. Orders have included a 5,000-kw. transformer and two 800-amp. circuit breakers; regularly scheduled heavy shipments of stock size transformers for service extensions; several 1,500 lot orders for fractional horsepower motors for furnace and pumping service on long-term deliveries; a group of 150-kw. transformers for a canning company; and a 20,000-kva. synchronous condenser for Pacific Gas & Electric Co. $100,318 was low bid for motor driven traveling crane for Keswick plant near Shasta Dam of Central Valley Project.

Industrial developments include a $15,000,000 strip steel addition to Kaiser's Fontana mill; $750,000 expansion of West End Chemical Co.'s plant in Inyo County, Calif.; and two canning factories, aggregating $1,000,000, in San Leandro.

CHICAGO

Public Service Co. of Northern Illinois reports it has anticipated its needs in the way of supplies in some cases 90 days hence, and therefore has not been adversely affected by strikes thus far. In addition, construction contract labor has eased since the war, thus permitting much work hitherto held up.

The utility's reemployment of veterans since V-J day has proceeded at an average rate of four a day; more than 700 of the 1,280 in service have returned. In November and December, men were returning at the rate of six a day due to what seemed to be a rush to get them home by Christmas. In recent weeks, the rate has tapered off somewhat, so that it is likely to level off at two a day. This is adequate considering that the firm still has little merchandise business due to lack of appliances.

During 1945, the firm built 264 miles of rural power lines, 200 of them since summer, making electricity available to 1,100 more farms. At the end of the year, 91.1 percent of farms and other rural units had electricity. The job of rural electrification will be completed by the end of this year.

Production of washing machines may end within two weeks unless steel and electrical strikes are settled, according to manufacturers in this area. Strikes have already forced January output below that of December, despite plans of manufacturers to make January reach pre-war levels. December shipments of washers and ironers was 65,000, or about 40 percent of prewar rates. Sonora Radio & Television Corp. has attained a production rate of 30,000 radios per month and expects to hit 40,000 by March 1, barring stoppages due to steel shortages.

NEW YORK

Industrial production is showing the effect of strikes, but new order volume continues heavy.

Civil engineering construction volume in continental United States totaled $55,527,000 for the week ending February 7, 1946, as reported to *Engineering News-Record*. This volume was 21 percent below the previous week and 169 percent greater than the corresponding week last year. Private construction volume for the week was 30 percent below the previous week, but 328 percent above the corresponding week last year. Public construction, 7 percent over the preceding week and 57 percent over the corresponding week of last year, gained largely due to state and municipal construction's increase of 15 percent over the preceding week and 572 percent increase over the 1945 week. The six-week cumulative total for 1946, $403,804,000, was 275 percent greater than the $137,500,000 reported for the similar period of 1945.

Sharp gains were reported last week in retail trade in the metropolitan area. Estimates indicated department store volume rose about 30 percent over last year.

NEW ENGLAND

Industrial electrical equipment continues to move on a restricted basis. According to one manufacturer, orders for 1 to 7½-hp. motors are being received in good quantity, and deliveries are being carried out for general purpose motors of which a fairly good stock remains; however, for special ratings, bookings are being made with "indefinite delivery." Small factory changes and modernization are active in eastern Massachusetts. All steel wiring materials are scarce although wire in small lots is obtainable.

Interest is increasing in electric neutralizer equipment to overcome the handicaps of static charges in processing textile materials and in working on paper in the printing industry. The Chapman Co., Portland, Me., reports much activity in this field.

Interest in quick freezing units is spreading throughout New England. Steps are being taken to add turkey and poultry freezers in western Massachusetts where installations are multiplying, and eastern Maine communities are interested in building central housing for several hundred lockers to provide local facilities. Suffolk Downs will install telefilm control at its East Boston race track this spring. Six control towers, a laboratory, and projection room will be built. The Electronics Division of Maguire Industries Inc., Bridgeport, Conn., has announced a new model aircraft range receiver which is now in full production.

How to design, construct, and calculate performance of

POWER-TRANSMISSION LINES

JUST PUBLISHED

Get in on the postwar boom in rebuilding and expanding transmission lines.....

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General Engineer, Carolina Power and Light Company

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O. Z. Announces New Distribution Plan

A new sales policy has been adopted for the distribution of the full O. Z. line of electrical products, Sales Manager Eric Nelson of O. Z. Electrical Manufacturing Co. has announced from the company's main office in Brooklyn.

Since early 1945 stocks have been carried by electrical distributors in principal cities from coast to coast and direct sales by O. Z. have been discontinued.

Mr. Nelson stressed that the new plan will by no means deprive users of O. Z. products of the company's long-established engineering and consultation service. On the contrary, he pointed out, such service will be more conveniently available to customers than ever, through the co-operation of the selected local distributors.

•

Industria Electrica Opens Office in New York

Industria Electrica de Mexico, S. A., in order to maintain liaison with, and to expedite purchases in New York for its initial $10,000,000 plant in Mexico, has opened an office at 15 Broad St., New York, with Paul C. K. Smith as New York representative. Mr. Smith was formerly with Westinghouse Electric International Co.

Industria Electrica was organized a few months ago to manufacture and sell in Mexico electrical apparatus and household appliances, principally under license from Westinghouse Electric Corp. and its subsidiary, Westinghouse Electric International Co.

Kuhn, Loeb & Co. recently headed an underwriting group which offered 197,500 American shares (representing a similar number of common shares of 100 pesos par value, Mexican currency), of Industria at $23 a share. In addition, Mexican capital to the extent of more than $10,000,000 was subscribed for stock and bonds in the company.

•

Commercial Cooking Units Fully Reconverted

Full reconversion for peace-time output of electric commercial cooking equipment has been announced by Edison General Electric Appliance Co.

Many items of this equipment were produced without interruption during the war for Army and Navy installations, according to Grant Call, commercial cooking equipment manager.

Mr. Call said that production on items being reintroduced is not up to pre-war pace, but full prewar output will be reached by late spring.

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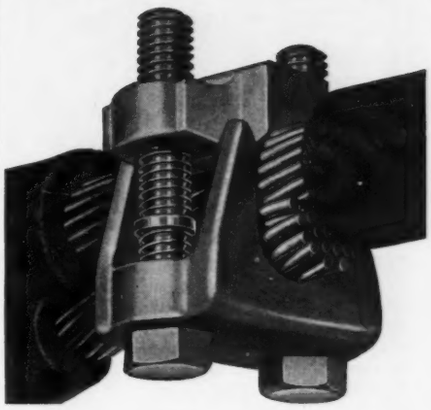
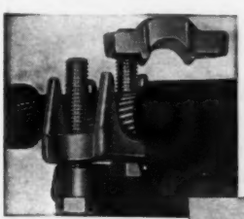
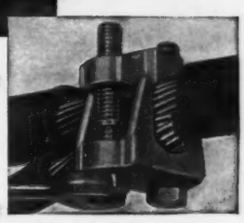


Made for use on copper or aluminum wires from 2/0 to 1000 MCM inclusive. They will connect two wires of their rated size or one wire of their rated size with one or more smaller tap-off wires down to No. 8 solid. They have many advantages over the larger sizes of connectors of the split bolt and other designs as they provide greater pressure between wires, hence greater holding power, are less costly, are easier to install and the assembled design is such that parts cannot become separated.



Fit on conductor as shown. Position top member and partially thread in free bolt.



Insert tap wire and equally draw up both bolts.

Write for Bulletin 206

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Sales Opportunities

ILLINOIS—Commonwealth Edison Co., Chicago, has completed plans for proposed expansion in Calumet generating station, comprising two building extensions, 141 by 200 ft. and 150 ft. high; and 143 by 165 ft., and 51 ft. high, respectively, for steam and electric divisions. Plans have been filed and erection will proceed at once; general construction award, exclusive of equipment, has been made to Herlihy-Mid-Continent Co., 79 West Monroe St., Chicago. Cost of structures with certain facilities estimated at $2,000,000. Installation will include new 107,000-kw. hydrogen-cooled turbine-generator, high-pressure boilers and auxiliary equipment, enlargement of switchyard and additional transmission lines. Entire project will cost in excess of $10,000,000. Holabird & Root, 333 North Michigan Ave., are architects; and Sargent & Lundy, Inc., 140 South Dearborn St., consulting engineer, both Chicago.

WASHINGTON—Weyerhaeuser Timber Co., Pulp Division, Longview, plans new bleached sulphite mill at local plant, comprising group of one and multi-story buildings, with machinery and electrical equipment for processing capacity of about 70,000 tons annually. Also will modernize and improve present pulp mill unit for conversion from lime base to magnesium base process, with mechanical and electrical facilities for this purpose. Capacity of power plant will be increased. Entire development is reported to cost approximately $5,000,000. Work scheduled to begin at early date. Otto G. Schoenwerk, 3240 North Shore Dr., Chicago, Ill., is consulting engineer.

IOWA—Board of City Trustees, Villisca, C. G. Hillcary, secretary, will receive bids until March 1 for extensions in municipal power plant, including (1) Addition to present building, 23 by 45 ft., with air and exhaust structures, etc.; (2) Furnishing and installing new diesel engine-generator unit and accessories, rating 1,000 to 1,250 bhp.; (3) Switchboard extension, with new generator and feeder panels, voltage regulators, etc.; (4) Steel fuel oil storage tank, pumping unit, piping, wiring, etc., all as per plans and specifications on file.

OKLAHOMA—U. S. District Engineer Office, Tulsa, will issue call for bids on or about March 1, to close 30 days later, for construction of Fort Gibson dam on Grand (Neosho) River, about five miles from Fort Gibson, consisting of a gravity type concrete dam with power plant and miscellaneous structures, including elevator, stair tower, etc.

GEORGIA—Ford Motor Co., Dearborn, Mich., has plans maturing for proposed new assembling plant at Hapeville. It will consist of a main one-story building, about 500,000 sq. ft. floor space, with machinery and electrical equipment for rated output of 350 cars per day; also several auxiliary structures. A power plant will be built. Entire project will cost approximately $8,500,000. Proposed to begin work in March. Albert Kahn Associated Architects & Engineers, New Center Building, Detroit, Mich., is architect and engineer.

WEST VIRGINIA—Monongahela Power Co., Fairmont, plans extensions and improvements in system at Parkersburg and vicinity, including additional transmission and distribution lines, power substations and other facilities, as well as rural lines. Cost estimated close to $500,000.

CALIFORNIA—Bureau of Reclamation, Denver, Colo., will receive bids until March 6 for one operating pump with control equipment, and steel-plate inlet and discharge pipes, for 72 by 93-in. horizontal jet pumping installation for fish trap at Keswick dam, Central Valley project. Equipment will be installed by government (Specifications 1163).

GEORGIA—Holfast Rubber Co., 1486 Lakewood Ave., S.E., Atlanta, lately acquired by new interests, plans two new one and multi-story additions, with machinery and electrical equipment for large increased capacity. Cost close to $1,000,000, with about $700,000 of that amount to be expended for equipment.

ILLINOIS—Iowa-Illinois Gas & Electric Co., Rock Island, plans expansion and improvements in generating station at Moline and Riverside plant at Davenport, Iowa, during present year, forming part of a general development program now being arranged. Also will make extensions in transmission and distribution lines in these and other districts, including new power substations and other operating facilities. Entire project is estimated to cost about $2,500,000. Work is scheduled to begin soon.

INDIANA—Ingersoll Steel Division, Borg-Warner Corp., New Castle, plans modernization and expansion in local plant, including additions to rolling mill and other buildings, with machinery and electrical equipment for large increased output. New furnaces will be installed. Power station facilities will be enlarged. Entire project is estimated to cost about $875,000. Main offices of company are at 310 South Michigan Ave., Chicago, Ill.

CALIFORNIA—Bureau of Reclamation, Friant, will receive bids until March 15 for drum gates, control equipment and miscellaneous metal work at Friant dam, Friant Division, Central Valley project. Development is located on San Joaquin River, with contract to include installation and testing of equipment noted (Specifications 1154).

ILLINOIS—Electro-Motive Division, General Motors Corp., LaGrange, diesel-electric locomotives, has revised plans in progress for proposed new power station at plant, and will ask bids in near future. Cost estimated about $750,000 with equipment. Schmidt, Garden & Erikson, 104 South Michigan Ave., Chicago, are consulting engineers.

IOWA—Board of Public Utility Commissioners, Alta, T. C. Olson, chairman, has authorized extensions and improvements in municipal power plant, including consolidation of two present small stations, and installation of new turbine-generator, boiler and auxiliary equipment for increased capacity. Largest of present plants will be used as future single station, and new addition constructed to accommodate added equipment. An engineer will be selected soon to prepare plans and make estimates of cost.

CALIFORNIA—Bureau of Reclamation, Denver, Colo., will receive bids until March 15 for galvanized steel towers and accessories for new 230-kv. transmission line from Oroville to Sacramento, Central Valley project. Towers will be installed by government (Specifications 1162).

Recent Rate Changes

UNION ELECTRIC CO. OF ILLINOIS has received approval of the Illinois Commerce Commission of a rate schedule that will save 121 schools, religious, and charitable institutions in the East St. Louis area $4,143 annually, based on 1945 usage.

FORT WAYNE LIGHT & POWER UTILITIES has filed with the Public Service Commission of Indiana for approval new light and power schedules which will mean a savings to customers of 13.8 percent or about $155,000 based on 1945 revenues. If approved, the new rates will become effective March 1. Residential rates proposed are 3.25 cents per kw.-hr. for the first 60 kw.-hr. per month, 2 cents per kw.-hr. for the next 120, and 1.5 cents for all over 180 kw.-hr. If a water storage heater is installed, the rate for all over 180 kw.-hr. in a month drops to 1 cent. The commercial schedule is 3.25 cents per kw.-hr. for the first 100 kw.-hr. per month, 3 cents a kw.-hr. for the next 400 kw.-hr., 2.5 cents a kw.-hr. for the next 2,000 kw.-hr., 2 cents a kw.-hr. for the next 2,500 kw.-hr., and 1.5 cents a kw.-hr. for all over 5,000 kw.-hr. For industrial users the demand charge is $1.75 per kva. for the first 50 kva., $1.50 for the next 50, $1.25 for the next 100, $1 for the next 300, 75 cents for the next 500, and 50 cents for the next 1,000. The energy charge is first 100-hr. use of billing demand at 1.6 cents, next 100 at 1 cent, next 100 at 0.8 cents, next 100 at 0.6 cents, over 400 at 0.5.

KENTUCKY UTILITIES CO. has received approval from the Kentucky Public Service Commission to reduce its rates approximately $250,000 a year beginning with February 1 meter readings. The reductions are in seven classifications. Reductions ranging from one to three-fourths of a mill a kw.-hr. go to 18 cooperatives. This will reduce the rate to co-ops to less than 1 cent a kw.-hr. Savings are calculated at $30,000 annually. Large power users will save $85,000. Mine power users will save $52,000. Other utilities including municipals will save $9,749. Power used by municipalities for pumping water will be $2,900 less. Small power consumers will save $12,600, and street lighting rates will drop $10,000 a year.

LOUISVILLE GAS & ELECTRIC CO. has received permission from the Kentucky Public Service Commission to reduce its rates about $600,000 a year, effective February 15. The residential rate on 100 kw.-hr. has been reduced from $3 to $2.75. The differential of 75 cents a month now paid by Jefferson County consumers outside of Louisville has been eliminated, and the differential paid by some 2,000 consumers outside of Jefferson County has been cut from 75 to 25 cents. Highest commercial rate of 3.8 cents a kw.-hr. in Louisville and of 4.8 cents a kw-hr. in the remainder of Jefferson County has been reduced to parity with the highest residential rate of 3.5 cents a kw.-hr.

•

Instrument Course to Open

The new industrial instrument maintenance and repair course of the Brown School of Instrumentation got under way on February 12 and continues to May 22. This course, second of the 1945-1946 season, will conclude the eleventh year the school has been conducted by the Brown Instrument Co. Special emphasis will be placed on the company's new electronic instruments.

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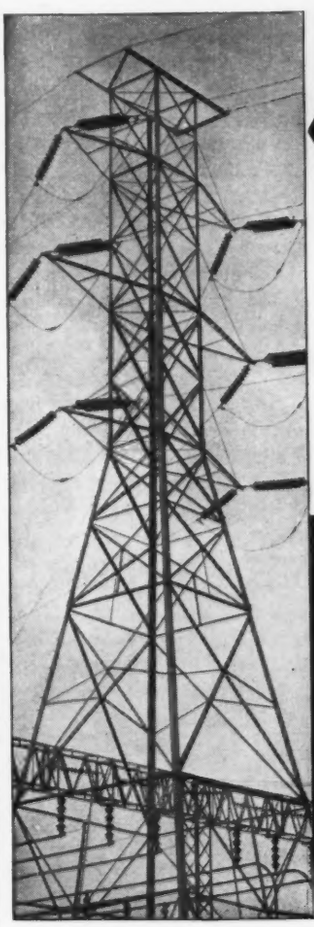

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LETTER TO THE EDITOR

Range Wiring Cost

To the Editor of ELECTRICAL WORLD:

I was interested in your January 5 ELECTRICAL WORLD editorial on the theme that range wiring doesn't have to be expensive. The conclusions reached are perfectly logical, and I thought you might be interested in some of our range and water heater wiring costs. We have a pretty good saturation of these heavy duty appliances among our residential customers, about 50 percent on ranges and 25 percent on water heaters. Under our arrangements with all dealers, we handle all installations of ranges and water heaters for new sales or directly with the customers where they secure them in some manner. Likewise, after the initial installation, we move these appliances to a new location twice at no charge to the customer. This, of course, is a great sales help with customers who rent houses, and we have found it very satisfactory.

Our policy is to install a three-No. 6 entrance cable with a 60-amp., 3-pole, no fuse breaker with the usual lighting and other house circuits, thus having breaker protection in addition to the range. When a sale has been made by a dealer he notifies us and delivers the appliance to the customer. We send our layout man to the location; he makes a sketch of the installation to be made and we in turn place an order for the work to be done with one of a number of electrical wiring contractors who do this work for us. After the work has been done, the contractor, of course, submits his invoice and we compare this with the estimate made by our layout man and pay the contractor.

The dealer accompanies every installation request for a new range with a check for $20, and every installation request for a new water heater with a check for $12.50. This presumably is collected from the customers in addition to the sales price of the appliance. Our board stands all wiring expense above these amounts up to $40 on ranges and $35 on water heaters. After the appliances have been installed 90 days, $5 of the range $20 and $2.50 of the water heater $12.50 is rebated to the dealer. This is done as a protection against repossessions. The installation cost very seldom exceeds $40 and $35, and where it does this amount is paid by the customer directly to the contractor.

During the last five months our installation costs on 168 new ranges and moves have averaged $37.22 each; on 237 water heaters (including plumbing) $26.57 each; and on 16 combined installations of range and water heater $62.79. On 91 new range installations alone the average cost has been $38.02; on 221 new water heater installations alone the average cost has been $65.22. On 77 moves range costs alone were $36.27; on 16 water heater moves alone the average installation cost was $24.74; on 10 combined moves the average installation cost was $61.34. All these costs were billed to us in accordance with uniform electrical wiring contractors' billing procedure.

Some time ago, I checked them with our same average costs for this type of work in 1941 and found that we were paying only about 25 percent more than at that time. This, of course, is not unexpected nor unreasonable.

We, of course, have some overhead expense in our office handling this type of work, but I believe our moderate costs are a reflection of this careful attention we give. Electrical wiring installation costs have gotten pretty high in our city but not upon this type of work. Obviously, being in a position to proportion out a considerable volume of work and the contractors having the knowledge that we know about what each job should cost, the contractors make an effort to see that we are not billed excessively. In order to encourage commercial cooking, we bear a portion of the installation costs, and our experience was that until we began to handle them in the same manner that we do domestic heavy duty appliances, wiring-in costs were pretty high, in fact so high in several instances as to kill an installation.

S. R. Finley, General Superintendent, Electric Power Board of Chattanooga, Chattanooga, Tenn.

•

REA Pole Situation

To the Editor of ELECTRICAL WORLD:

Referring to the following news item appearing on page 4 of your January 12, 1946, issue:

"REA officials estimate that REA borrowers will need 8,500,000 poles to carry through their 3-year construction program and possibly over 2,500,000 annually thereafter. At the current rate of production, it is estimated the industry will fail to meet these needs by at least a million poles a year."

It has been my experience that setting wood poles in concrete increases the life thereof at least 25 percent, possibly more.

Maybe some of your readers can give some definite figures on this subject. Seemingly it would be worth while.

Harold M. Gould,
89 Prospect Street,
Bridgeport, Conn.

Recent Legislation

Among the bills introduced in various state legislatures, affecting the electric industry, are the following:

GEORGIA—City of Columbus has been granted authority to condemn public utilities and thereby establish municipally owned power plants in a bill passed by the House. The city is at present being served by the Georgia Power Co.

KENTUCKY—A bill described by its sponsors as being similar in essential respects to the 1944 attempt to amend the TVA Act enabling Kentucky cities to acquire their own electric utility plants has been introduced in the Senate by Senator Ray B. Moss, Pineville, Republican floor leader. "This is not an anti-TVA bill," Senator Moss said. "The dam (TVA's Kentucky Dam at Gilbertsville) is already built, and TVA is here to stay. The only thing this bill does is to try to put private utilities in Kentucky on an equal footing with TVA". Senator Moss said the three salient features of his bill are: (1) Repeal of the section which now allows a city to build a duplicate plant of its own in the event it fails to acquire existing facilities of the utility the city seeks to buy; (2) Enactment of a new section making it mandatory upon a city to accept arbitration, as well as mandatory upon the utility; (3) Enactment of a detailed formula for calculation of a fair purchase price to be paid by a city for the private utility it seeks to acquire. Senator Henry Ward, Paducah, charged that the bill is aimed directly at defeating Paducah's current negotiations to buy local facilities of Kentucky Utilities Co. for municipal operation. H. Curtis Brown, Brandenburg, president of the Kentucky Association of Rural Electric Cooperatives, charged that private utilities are trying to railroad through the General Assembly the "joker-filled" bill.

RHODE ISLAND—A bill which would authorize cities and towns to acquire, own, and operate municipal electric light plants appeared again in the House of Representatives recently. For the third consecutive year it was introduced by Eugene Lanctot, Democrat, of Woonsocket. It was referred to the committee on corporations.

SOUTH CAROLINA—Legislative control of the Santee-Cooper project, proposed in a bill by Representative R. M. Kennedy, has been rejected by the House despite Mr. Kennedy's allegations that the project was "losing money" and was "inefficiently administered." The bill failed to pass, however, by the narrow margin of one vote. The count was 49-48. The bill would have required annual legislative approval of the authority's budget.

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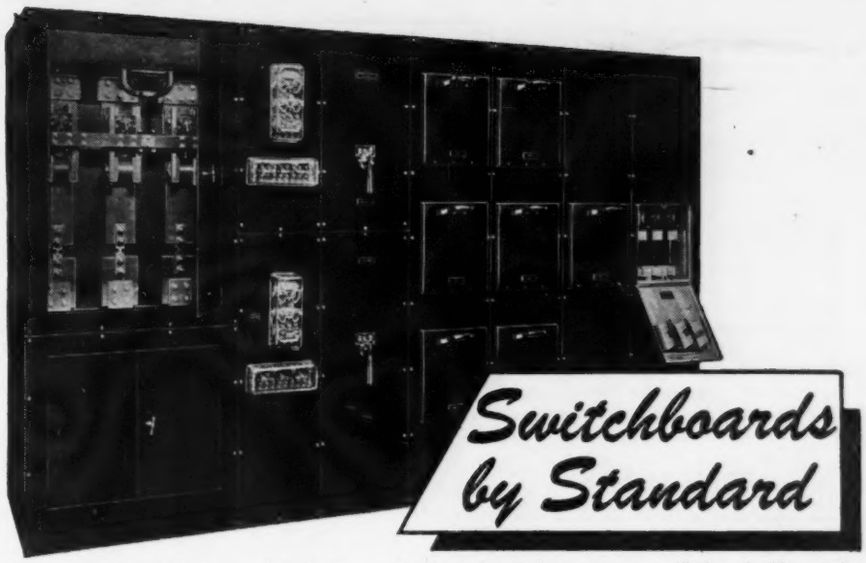
Issue Covers Farm Life

The February issue of the EMPIC *Movie Guide*, a monthly review of educational, training and other sponsored films, published by the Electrical Manufacturers Public Information Center for the guidance of schools, clubs and other interested groups, will cover films available upon agriculture, farm life and farm problems in the United States. A special supplement, included as background material, reviews some twenty films depicting farm life and conditions in foreign countries.



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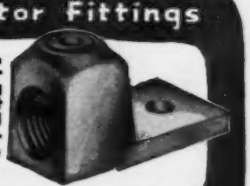

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